DOCUMENT RESUME

ED 235 277 UD 023 127

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TITLE	Senior High School Biological Sciences.
INSTITUTION	Duval County Schools, Jacksonville, Fla.
PUB DATE	82
NOTE	212p.; A publication of the Division of Instruction.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01/PC09 Plus Postage.
DESCRIPTORS	Anatomy; *Behavioral Objectives; *Biological Sciences; Biology; Course Descriptions; Ecology; High Schools; Physiology; Research Projects; Resource Materials; Science Curriculum; Science Education; *Science Instruction; *Secondary School Science; Student Research; Zoology

ABSTRACT

Instruction in the biological sciences is the topic of this guide developed for high schools in Duval County, Jacksonville, Florida. The subjects covered are: (1) Anatomy and Physiology for 10th, 11th, and 12th graders; (2) Biology I for 10th, 11th, and 12th graders; (3) Biology I, Advanced, for 9th, 10th, 11th, and 12th graders; (4) Biology II, Advanced, for 11th and 12th graders; (5) Ecology for 10th, 11th, and 12th graders; (6) Science Survey, Biological, for 10th, 11th, and 12th graders; (7) Zoology for 11th and 12th graders; and (8) Science Research, Advanced, for 11th and 12th graders. For numbers 1-7, the following are provided: notes to the teacher, performance objectives, course outline, key to recommended instructional materials, and key to laboratory resources. In Science Research, students are expected to complete an independent research project, and general recommendations are provided for this course. (CMG)

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1982

SENIOR HIGH SCHOOL BIOLOGICAL SCIENCES

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CURRICULUM DEVELOPMENT AND MLST STATUS

SECONDARY SCIENCE COURSES

1982-1983

COURSE	GRADE LEVEL	CURRICULUM	MLST
Anatomy and Physiology	SHS	No changes	On line
Biology I	SHS	No changes	On line
Biology I, Adv.	JHS/SHS	Slight revisions	On line
Biology II, Adv.	SHS	New	Field Test
Chemistry I	SHS	No changes	On line
Chemistry I, Adv.	SHS	Slight revisions	On line
Chemistry II, Adv.	SHS	New	Field Test
Earth/Physical Science, Adv.	JHS	New	Field Test*
Earth Science	SHS	No changes	On line
Earth Science 9	JHS	New	Field Test
Ecology	SHS	No changes	On line
Life Science 7	JHS	No changes	On line
Life Science 7, Adv.	JHS	No changes	On line
Marine Biology I	SHS	No changes	On line
Marine Biology II, Adv.	SHS	Major revisions	Field Test
Marine Science	SHS	Slight revisions	On line
Physical Science 8	JHS	Slight revisions	On line
Physical Science II	SHS	No changes	On line
Physics I	SHS	Slight revisions	On line
Physics I, Adv.	SHS	No changes	On line
Physics II B, Adv.	SHS	New	Field Test
Science Survey, Biol.	SHS	No changes	On line
Science Survey, E/S	SHS	No changes	On line
Science Survey, Phys.	SHS	Slight revisions	On line
Zoology	SHS	Slight revisions	On line

* In 10 junior high schools; students in all other schools take on-line MLST.

INTRODUCTION
ANATOMY AND PHYSIOLOGY

State Accreditator Number. .	1371
Course Code Number	2615
F.T.E. Category.	1.10
Instructional Level.	Standard

Report Card Abbreviation . .	Anat and Phys
Length of Course	Year
Credit	1 Science credit
Grade Level.	10, 11, 12

Prerequisites

Biology I (C or better recommended). Teacher recommendation.

Textbook(s)

Miller, M. A., et al, Anatomy and Physiology (New York: Macmillan Publishing Co., 1977).

Notes to Teachers

This course includes higher level as well as minimum level objectives. Students are to develop laboratory skills as well as content knowledge.

The Minimum Level Skills (MLS) objectives are indicated with an asterisk (*) and will be the only objectives tested on the Minimum Level Skills Test (MLST). The "Teaching Time" listed on the Key to Instructional Materials is a suggested range, assuming no one will need the maximum time on every objective, to help insure that all MLS objectives can be met by Minimum Level Skills Test time.

Laboratory skills are indicated with a plus sign (+). Suggested resources for teaching these skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources.

COURSE OUTLINE

ANATOMY AND PHYSIOLOGY

- 1.0 Introduction
  - *1.1 Disciplines: Anatomy/Physiology
  - *1.2 Anatomic Terminology
  - 1.3 Body Planes
  - 1.4 Cavities
    - *1.4.1 Celom
    - 1.4.2 Organs
  - 1.5 Systems
    - 1.5.1 Organization levels
    - 1.5.2 Organs
    - *1.5.3 Functions
- 2.0 Tissues
  - 2.1 Epithelial
    - *2.1.1 Functions
    - 2.1.2 Types
    - 2.1.3 Glands
    - *2.1.4 Skin functions
  - 2.2 Connective
    - 2.2.1 Types
    - *2.2.2 Fibers
    - 2.2.3 Cell types
    - *2.2.4 Cancellous/Compact
    - 2.2.5 Bone marrow
    - 2.2.6 Bone ultrastructure
  - 2.3 Muscle
    - 2.3.1 Properties
    - *2.3.2 Types
  - 2.4 Nervous
    - 2.4.1 Properties
    - *2.4.2 Neuron function
    - *2.4.3 Neuron structure
    - 2.4.4 Axon/Dendrite
    - 2.4.5 Neuron types
    - 2.4.6 Permeability changes
  - +2.5 Tissue Identification
- 3.0 Locomotion/Support
  - *3.1 Bones: Axial/Appendicular
  - 3.2 Bone Formation
    - 3.2.1 Ossification
    - *3.2.2 Osteoblast
  - 3.3 Muscle Identification
  - 3.4 Muscle Function
    - *3.4.1 Sarcomere
    - 3.4.2 Origin/Insertion
    - *3.4.3 ATP
    - 3.4.4 Sliding bar mechanism
    - 3.4.5 Chemical changes
    - 3.4.6 Oxygen debt
  - +3.5 Bone Identification
  - +3.6 Muscle Dissection
  - +3.7 Muscle Fatigue
- 4.0 Nervous System
  - 4.1 Reflexes
    - *4.1.1 Reflex arc
    - 4.1.2 Examples
  - 4.2 Spinal Cord
    - 4.2.1 Location/Structure/Function
    - *4.2.2 Protection
    - 4.2.3 Spinal nerve roots
  - 4.3 Brain
    - 4.3.1 Parts
    - *4.3.2 Cerebrum
    - 4.3.3 Hypothalamus
    - *4.3.4 Cerebellum
    - 4.3.5 Cranial nerves
  - +4.4 Vertebrate Dissection
  - +4.5 Reflex Action
- 5.0 Cardiovascular System
  - 5.1 Blood
    - 5.1.1 Composition
    - 5.1.2 Red blood cell structure
    - 5.1.3 Leukocytes
    - *5.1.4 Red blood cell function
    - 5.1.5 Blood cell formation
    - *5.1.6 Hemoglobin
    - 5.1.7 Noncellular components

* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

ANATOMY AND PHYSIOLOGY

- 5.2 Clot Formation
- 5.3 Blood Vessels
  - 5.3.1 Structure
  - *5.3.2 Artery/Vein
  - 5.3.3 Vasa vasorum
  - 5.3.4 Valves
- 5.4 Lymphatic System
  - 5.4.1 Lymph
  - *5.4.2 Functions
  - 5.4.3 Lymph nodes/Spleen/Thymus/Tonsils
- 5.5 Heart
  - *5.5.1 Structures
  - 5.5.2 Valves
  - 5.5.3 Papillary muscles/Chordae tendinae/SA node/AV node
  - *5.5.4 Coronary circulation
  - 5.5.5 Cardiac cycle
  - *5.5.6 Blood flow
- +5.6 Vertebrate Dissection
- +5.7 Pulse Rate/Blood Pressure
- +5.8 Blood Typing

6.0 Respiratory System

- 6.1 Respiratory Tract
  - *6.1.1 Nose functions
  - 6.1.2 Stratified squamous epithelium
- 6.2 Larynx
  - *6.2.1 Function
  - 6.2.2 Structure
- 6.3 Trachea/Bronchi
  - 6.3.1 Location/Function
  - 6.3.2 Ciliated epithelium
- 6.4 Lung
  - 6.4.1 Structure
  - *6.4.2 Alveoli
  - 6.4.3 Pulmonary circulation
- 6.5 Respiration
  - 6.5.1 Inspiration/Expiration
  - *6.5.2 Diaphragm
  - 6.5.3 External
  - *6.5.4 Internal
  - 6.5.5 Control
- +6.6 Vertebrate Dissection
- +6.7 Measurement: Thorax/Abdomen

7.0 Digestive System

- 7.1 Alimentary Canal
  - *7.1.1 Organs
  - 7.1.2 Organ functions
  - 7.1.3 Tongue: glands, taste buds
  - 7.1.4 Salivary glands
  - 7.1.5 Stomach
  - 7.1.6 Small intestine
  - *7.1.7 Villi/Microvilli
  - 7.1.8 Large intestine
- 7.2 Accessory Organs
  - 7.2.1 Pancreas
  - 7.2.2 Endocrine/Exocrine
  - *7.2.3 Pancreatic secretions
  - 7.2.4 Liver
  - 7.2.5 Hepatic portal system
  - *7.2.6 Gall bladder
- 7.3 Digestive Process
  - 7.3.1 Nutrients
  - 7.3.2 Digestion
  - *7.3.3 Hydrolysis
  - *7.3.4 End products
  - 7.3.5 Hormones/Enzymes/Hydrochloric acid
  - 7.3.6 Anabolism/Catabolism
- +7.4 Vertebrate Dissection
- +7.5 Enzyme Action

ANATOMY AND PHYSIOLOGY

- 8.0 Urinary System
  - *8.1 Structures
  - 8.2 Kidney
    - 8.2.1 Structure/Function
    - *8.2.2 Nephron function
    - *8.2.3 Nephron structure
    - 8.2.4 Urine formation
    - 8.2.5 ADH
  - +8.3 Vertebrate Dissection
  - +8.4 Urinalysis

- 9.0 Reproductive System
  - 9.1 Male Organs
  - 9.2 Female Organs
  - 9.3 Female Hormones
  - 9.4 Oogenesis/Spermatogenesis
  - +9.5 Vertebrate Dissection

- 10.0 Special Senses
  - 10.1 Hearing
    - 10.1.1 Auditory apparatus
    - 10.1.2 Pinna/Tympanic membrane
    - 10.1.3 Ear ossicles
    - 10.1.4 Internal ear
  - 10.2 Vision
    - 10.2.1 Eye structure
    - 10.2.2 Eye functions
    - 10.2.3 Physiology
  - +10.3 Eye Dissection

PERFORMANCE OBJECTIVES
ANATOMY AND PHYSIOLOGY

To demonstrate the ability to recall and apply knowledge of general structure, tissues, locomotion and support, nervous, cardiovascular, respiratory, digestive, urinary, and reproductive systems, and special senses, students will master the performance objectives listed below. Successful completion of Anatomy and Physiology is based on teacher judgment and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 Introduction

*1.1 Students will identify the following disciplines from a description: gross anatomy, microscopic anatomy, histology, embryology, comparative anatomy, or physiology.

*1.2 Students will identify definitions of the following anatomic terms: anterior, ventral, posterior, dorsal, cranial, caudal, superior, inferior, medial, lateral, proximal, distal, internal, or external.

1.3 Students will identify the following body planes: sagittal, transverse, or coronal sections.

1.4 To demonstrate knowledge of cavities, students will:

*(1) identify a definition of celom; and

(2) list the organs found in each of the following cavities: thoracic, abdominal, pelvic, and buccal.

1.5 To demonstrate knowledge of systems, students will:

(1) explain the relationship between: cell, tissue, organ, and system;

(2) identify the organs found in the skeletal, muscular, nervous, circulatory, lymphatic, digestive, respiratory, urinary, reproductive, and integumentary systems; and

*(3) identify the functions of the skeletal, muscular, nervous, circulatory, lymphatic, digestive, respiratory, urinary, reproductive, or integumentary systems.

2.0 Tissues

2.1 To demonstrate knowledge of epithelial tissues, students will:

*(1) identify the three general functions of the epithelial tissues as protection, secretion, and absorption;

(2) identify the types of epithelial tissue from descriptions of their structure and function;

(3) identify types of glands from descriptions of their structure; and

*(4) identify the functions of the skin as (a) protection from drying and injury, (b) protection from infectious organisms, (c) temperature regulation, and (d) excretion.

2.2 To demonstrate knowledge of connective tissues, students will:

(1) identify a description and function for each type of connective tissue;

*(2) identify collagen, reticular, and elastic as the types of fibers found in connective tissue;

(3) identify the types of cells found in connective tissue;

*(4) identify the location of cancellous bone tissue as being in the interior of a bone or compact bone tissue as being found on the exterior;

(5) identify the location, functions, and types of bone marrow; and

(6) label the haversian system, haversian canal, lamellae, canaliculi, and lacunae when given a diagram of the ultrastructure of bone.

2.3 To demonstrate knowledge of muscle tissues, students will:

(1) identify contractility and conductivity as the properties of muscle; and

*(2) identify smooth, striated, or cardiac muscle from a description of the structure, function, or location within the body.

2.4 To demonstrate knowledge of nervous tissue, students will:

(1) identify irritability and conductivity as the properties of nervous tissue;

*(2) identify the neuron as the functional unit of nervous tissue;

*(3) identify the denurite, axon, and cell body when given a diagram of a neuron;

(4) distinguish between the action of an axon and a dendrite;

(5) identify three types of neurons by their shapes; and

(6) describe the permeability changes which occur in the nerve membrane during transmission of a nerve impulse.

+2.5 Students will observe and identify microscopic and kodachrome slides of body tissues when available.

3.0 Locomotion and Support

*3.1 Students will identify examples of bones which make up the axial or appendicular skeleton.

3.2 To demonstrate knowledge of bone formation, students will:

(1) explain intramembranous and intracartilaginous ossification; and

*(2) identify osteoblasts as bone-forming cells.

3.3 Students will identify selected human muscles from appropriate diagrams.

3.4 To demonstrate knowledge of muscle function, students will:

*(1) identify the sarcomere as the functional unit of muscle;

(2) distinguish between the origin and insertion of muscles from a written description of the muscle action;

*(3) identify ATP as the source of energy for muscle contraction;

(4) explain the sliding bar mechanism of muscle contraction;

(5) identify the chemical changes which take place during a muscle contraction; and

(6) justify the use of the term 'oxygen debt' in describing fatigue.

+3.5 Students will identify bones, bone cavities, and processes on a human skeleton.

+3.6 Students will dissect a vertebrate, locate and identify selected muscles, and explain the origin, insertion, and action of selected muscles.

+3.7 Students will demonstrate the effect of fatigue on muscles.

4.0 Nervous System

4.1 To demonstrate knowledge of the reflexes, students will:

*(1) identify the reflex arc as the functional unit of the nervous system; and

(2) give examples of reflexes.

4.2 To demonstrate knowledge of the spinal cord, students will:

(1) describe the location, structure, and function;

*(2) identify membranes, vertebral column, and fluid as the three ways in which the spinal cord is protected; and

(3) identify the motor and sensory roots of a spinal nerve.

4.3 To demonstrate knowledge of the brain, students will:

(1) label the parts of the brain when given an appropriate diagram;

*(2) identify the cerebrum as governing all mental activites such as reason, intelligence, will, and memory;

(3) identify the functions of the hypothalamus;

*(4) identify the functions of the cerebellum as the coordination of posture and equilibrium, and control of tone in voluntary muscles; and

(5) identify the cranial nerves by number, name, and function.

+4.4 Students will perform a dissection of a vertebrate to identify the brain and spinal cord.

+4.5 Students will demonstrate reflex actions in humans.

5.0 Cardiovascular System

5.1 To demonstrate knowledge of blood, students will:

(1) describe the composition of blood;

(2) describe the structure of red blood cells;

(3) identify the types of granular and agranular leukocytes from a description of structure and function;

*(4) identify transportation of oxygen to the tissues as a function of red blood cells;

(5) state the locations where red and white blood cells are formed;

*(6) identify hemoglobin as a combination of the protein globin, non-protein heme, and iron; and

(7) explain the role of non-cellular components of blood.

5.2 Students will describe the steps in the formation of a clot.

5.3 To demonstrate knowledge of blood vessels, students will:

(1) contrast the structure of arteries, veins, and capillaries;

*(2) identify the function of arteries and veins;

(3) describe the function of the vasa vasorum; and

(4) describe the function of the valves in the veins.

5.4 To demonstrate knowledge of the lymphatic system, students will:

(1) describe the composition and formation of lymph;

*(2) identify the functions of the lymph vessels as movement of fluids from tissues to veins, removal of protein from tissue fluid, and absorption of digested food; and

(3) identify location and function of lymph nodes, spleen, thymus, and tonsils.

5.5 To demonstrate knowledge of the heart, students will:

*(1) identify the atria, ventricles, septum, and aorta when given an appropriate diagram;

(2) identify the valves from descriptions of their structure, location, and function;

(3) explain the functions of papillary muscles, chordae tendinae, SA node, and AV node;

*(4) identify coronary circulation as delivering blood containing oxygen and nutrients to the cardiac muscles;

(5) describe a cardiac cycle; and

*(6) identify the correct path of the blood flow through the heart as: right atrium, right ventricle, lungs, left atrium, and left ventricle.

+5.6 Students will perform a vertebrate dissection, and be able to identify parts of the heart, major arteries, and major veins.

+5.7 Students will demonstrate the effect of exercise on pulse rate and blood pressure.

+5.8 Students will type a sample of human blood to determine blood group and Rh factor.

6.0 Respiratory System

6.1 To demonstrate knowledge of the respiratory tract, students will:

*(1) identify functions of the nose as filtering, warming, and moistening inhaled air; and

(2) identify stratified squamous epithelium as the lining of the nose.

6.2 To demonstrate knowledge of the larynx, students will:

*(1) identify the function of the larynx as the organ of voice; and

(2) describe its structure.

6.3 To demonstrate knowledge of the trachea and bronchi, students will:

(1) describe location and function of both; and

(2) explain the role of the ciliated epithelium.

6.4 To demonstrate knowledge of the lung, students will:

(1) describe the structure of the lung;

*(2) identify the alveoli as the location for oxygen-carbon dioxide exchange; and

(3) describe pulmonary circulation.

6.5 To demonstrate knowledge of respiration, students will:

(1) identify inspiration or expiration from a description;

*(2) identify the diaphragm as the principal muscle of respiration;

(3) identify the exchange of gases in the lungs as being external respiration;

*(4) identify internal respiration as the exchange of O_2 and CO_2 between the capillaries and tissues; and

(5) explain the role of carbon dioxide and the respiratory center in controlling respiration.

+6.6 Students will perform a vertebrate dissection and be able to identify the main organs of the respiratory system.

+6.7 Students will demonstrate changes in the dimensions of the thorax and abdomen while breathing.

7.0 Digestive System

7.1 To demonstrate knowledge of the alimentary canal, students will:

*(1) identify in order, the organs of the alimentary canal as: mouth, esophagus, stomach, small intestine, and large intestine;

(2) describe the function of each of the digestive organs;

(3) describe the role of the glands and taste buds on the tongue;

(4) identify the locations and secretions of the salivary glands;

(5) identify the cardia, fundus, body, and pyloric antrum of the stomach with an appropriate diagram;

(6) identify the duodenum, jejunum, and ileum as the three divisions of the small intestine;

*(7) identify the function of villi and microvilli as increasing the surface area of the small intestine for the absorption of nutrients in the small intestine; and

(8) identify the four regions of the large intestine as being the cecum, colon, rectum, and anal canal.

7.2 To demonstrate knowledge of the accessory organs of digestion, students will:

(1) describe the appearance and location of the pancreas;

(2) distinguish between structure and function of endocrine and exocrine glands;

*(3) identify pancreatic juice or insulin as a secretion of the pancreas;

(4) describe the structure and functions of the liver;

(5) explain the function of the hepatic portal system; and

*(6) identify the function of the gall bladder as being storage of bile.

7.3 To demonstrate knowledge of the digestive process, students will:

(1) describe the six kinds of nutrients and their food sources;

(2) explain the difference between physical and chemical digestion;

*(3) identify the definition of hydrolysis as the breakdown of complex molecules into simple molecules by the addition of water;

*(4) identify the end products of digestion as being amino acids, simple sugars, or fatty acids;

(5) identify the function of the hormones, enzymes, and hydrochloric acid; and

(6) discuss the differences between anabolism and catabolism.

+7.4 Students will dissect a vertebrate and be able to identify selected parts of the digestive system.

+7.5 Students will demonstrate the action of enzymes on the digestion of carbohydrates, proteins, and fats.

8.0 Urinary System

*8.1 Students will identify the kidney, urinary bladder, ureters, or urethra on a diagram.

8.2 To demonstrate knowledge of the kidney, students will:

(1) describe the structure and function;

*(2) identify the nephron as the functional unit of the kidney;

*(3) identify the glomerulus, Bowman's capsule, loop of Henle, or collecting tubule, when given a diagram of a nephron;

(4) describe the role of the nephron in urine formation; and

(5) describe the effect of ADH on reabsorption of water.

+8.3 Students will perform a vertebrate dissection and be able to identify selected parts of the urinary system.

+8.4 Students will perform a urinalysis to determine the composition of human urine.

9.0 Reproductive System

9.1 Students will identify the location, structure, and function of the male reproductive organs.

9.2 Students will identify location, structure, and function of the female reproductive organs.

9.3 Students will describe the effect of hormones on the ovary and uterus during the menstrual cycle.

9.4 Students will explain oogenesis and spermatogenesis.

+9.5 Students will perform a vertebrate dissection and be able to identify selected parts of the reproductive organs.

10.0 Special Senses

10.1 To demonstrate knowledge of the sense of hearing, students will:

(1) identify the external ear, middle ear, tympanic cavity, internal ear, acoustic nerve, and acoustic center as forming the auditory apparatus;

(2) identify the functions of the pinna and tympanic membrane;

(3) identify the function of the ear ossicles; and

(4) describe the structure and function of the parts of the internal ear.

10.2 To demonstrate knowledge of the sense of vision, students will:

(1) label the parts of the eye in a diagram of a horizontal section;

(2) identify the functions of the iris, rods, cones, and aqueous humor; and

(3) explain the physiology of vision.

+10.3 Students will dissect a vertebrate eye, identifying selected parts.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	Introduction	2 weeks	MLST	M. A. Miller, et al, *Anatomy and Physiology* (New York: Macmillan Publishing Co., Inc., 1977), Chapter 1.	T. F. Morrison, et al, *Human Physiology* (New York: Holt, Rinehart and Winston, Publishers, 1977), Chapter 1.
2.0	Tissues	4 weeks	MLST	Miller, Chapter 3; Chapter 9, pp. 201-09.	Morrison, Chapter 4. Chapter 6, pp. 79-84; Chapter 8, pp. 107-16; Chapter 26, pp. 356-65.
3.0	Locomotion/ Support	4 weeks	MLST	Miller, Chapters 4-8.	Morrison, Chapter 5; Chapter 6, pp. 87-90; Chapter 7, pp. 93-101.
4.0	Nervous System	4 weeks	MLST	Miller, Chapters 9-11.	Morrison, Chapter 8, pp. 103-06; Chapter 9.
5.0	Cardiovascular System	6 weeks	MLST	Miller, Chapters 15-18.	Morrison, Chapters 21-25.
6.0	Respiratory System	3 weeks	MLST	Miller, Chapter 19.	Morrison, Chapters 18-20.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
7.0	Digestive System	5 weeks	MLST	Miller, Chapters 20-22.	Morrison, Chapters 13-17; Chapter 28.
8.0	Urinary System	2 weeks	MLST	Miller, Chapter 23.	Morrison, Chapter 29.
9.0	Reproductive System			Miller, Chapter 25.	Morrison, Chapter 32, pp. 424-30.
10.0	Special Senses			Miller, Chapter 12, pp. 271-91.	Morrison, Chapters 10-12.

County Adopted Text:

M. A. Miller, et al, Anatomy and Physiology (New York: Macmillan Publishing Co., 1977).

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+2.5	observe and identify microscopic and kodachrome slides of body tissues when available.		A. B. Drakontides, et al, Anatomy and Physiology: Workbook and Laboratory Manual (New York: The Macmillan Company, 1972), pp. 15-26. T. G. Morrison, et al, Experiments in Physiology (New York: Holt, Rinehart and Winston, 1977), pp. 14-16.
+3.5	identify bones, bone cavities, and processes on a human skeleton.		Drakontides, pp. 35-58. Morrison, pp. 16-20.
+3.6	dissect a vertebrate, locate and identify selected muscles, and explain the origin, insertion, and action of selected muscles.		E. S. Booth, et al, Laboratory Anatomy of the Cat (Dubuque, Iowa: William C. Brown Company, 1967), pp. 14-30. Drakontides, pp. 59-92. D. Klingener, Laboratory Anatomy of the Mink (Dubuque, Iowa: William C. Brown Company, 1972), pp. 27-49. Morrison, pp. 20-22.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		S. Wischnityer, Atlas and Dissection Guide for Comparative Anatomy (San Francisco: W. H. Freeman and Company, 1972), pp. 117-29.
+3.7	demonstrate the effect of fatigue on muscles.		Drakontides, p. 88. Morrison, p. 21.
+4.4	perform a dissection of a vertebrate to identify the brain and spinal cord.		Booth, pp. 50-55. Drakontides, pp. 93-116. Klingener, pp. 85-91. Odlang, pp. 77-85. Wischnityer, pp. 187-92.
+4.5	demonstrate reflex actions in humans.		Drakontides, pp. 102-03. Morrison, pp. 23-24.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+5.6	perform a vertebrate dissection, and be able to identify parts of the heart, major arteries, and major veins.		Booth, pp. 38-46. Drakontides, pp. 147-53. Klingener, pp. 61-75. Odlang, pp. 55-71. Wischnityer, pp. 155-75.
+5.7	demonstrate the effect of exercise on pulse rate and blood pressure.		Drakontides, pp. 157-61. Morrison, pp. 49-50, 53-55.
+5.8	type a sample of human blood to determine blood group and Rh factor.		Drakontides, pp. 142-43. Morrison, pp. 48-49.
+6.6	perform a vertebrate dissection and be able to identify the main organs of the respiratory system.		Booth, pp. 38-46. Drakontides, pp. 167-69. Klingener, pp. 51-55. Morrison, p. 41.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
			Odlang, pp. 55-71. Wischnityer, pp. 152-53.
+6.7	demonstrate changes in the dimensions of the thorax and abdomen while breathing.		Drakontides, p. 169. Morrison, pp. 41-42.
+7.4	dissect a vertebrate and be able to identify selected parts of the digestive system.		Booth, pp. 31-37. Drakontides, pp. 177-85. Klingener, pp. 55-59. Odlang, pp. 35-42. Wischnityer, pp. 147-51.
+7.5	demonstrate the action of enzymes on the digestion of carbohydrates, proteins, and fats.		Drakontides, pp. 185-89. Morrison, pp. 36, 38, 39-40.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+8.3	perform a vertebrate dissection and be able to identify selected parts of the urinary system.		Booth, p. 46. Drakontides, pp. 195-98. Klingener, p. 77. Morrison, p. 63. Odlang, pp. 43-50. Wischnityer, p. 177.
+8.4	perform a urinalysis to determine the composition of human urine.		Drakontides, pp. 198-201. Morrison, pp. 63-66.
+9.4	perform a vertebrate dissection and be able to identify selected parts of the reproductive system.		Booth, pp. 47-50. Klingener, pp. 73-83. Odlang, pp. 44-50. Wischnityer, pp. 178-81.
+10.3	dissect a vertebrate eye, identifying selected parts.		Drakontides, pp. 121-23.

INTRODUCTION
BIOLOGY I

State Accreditator Number. .	1314
Course Code Number	2301
F.T.E. Category.	1.10
Instructional Level.	Standard

Report Card Abbreviation . .	Biology I
Length of Course	Year
Credit	1 Science credit
Grade Level.	10, 11, 12

Prerequisites

None

Textbook(s)

Oram, Raymond F., et al, *Biology Living Systems* (Columbus, Ohio: Charles E. Merrill Publishing Co., 1979).

Notes to Teachers

Full objectives are included in addition to the Minimum Level Skills objectives. Students are to develop laboratory skills as well as content knowledge.

The Minimum Level Skills objectives are indicated with an asterisk (*), and will be the only objectives tested on the MLST. The "Teaching Time" listed on the "Key to Instructional Materials" is a suggested maximum time for each objective to help insure that all MLS objectives can be met by MLST time.

Laboratory skills are indicated with a plus sign (+). Suggested resources for teaching the laboratory skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources.

Supplementary materials listed in keys are in order of preferred use.

COURSE OUTLINE

BIOLOGY I

- 1.0 Research Skills
  - 1.1 Scientific Method
    - 1.1.1 Steps
    - 1.1.2 Control & experimental elements
    - *1.1.3 Conclusion
  - 1.2 Data organization
    - +1.2.1 Record data
    - 1.2.2 Observations vs. assumptions
    - +1.2.3 Metric measurements
    - 1.2.4 Data chart
    - *1.2.5 Bar graph
    - *1.2.6 Line graph
  - 1.3 Microscope Skills
    - *1.3.1 Parts
    - *1.3.2 Functions
    - *1.3.3 Proper handling
    - *1.3.4 Image calculation
    - +1.3.5 Slide preparation

- 2.0 Basic Biochemistry
  - 2.1 Atomic Structure
  - 2.2 Chemical Energy
  - 2.3 Organic Compounds
    - *2.3.1 Carbohydrates
    - 2.3.2 Fats
    - *2.3.3 Proteins
    - +2.3.4 Food examples
  - *2.4 Enzymes

- 3.0 The Cell & Its Environment
  - *3.1 Levels of Organization
  - *3.2 Cell Theory
  - 3.3 Cell Structure
    - *3.3.1 Parts
    - 3.3.2 Organelles
    - *3.3.3 Plant/animal cells
    - 3.3.4 Structure & function
    - +3.3.5 Observation of cells
  - 3.4 Particle Movement
    - *3.4.1 Definition of diffusion, osmosis, active transport
    - 3.4.2 Examples
    - +3.4.3 Turgor

- 4.0 Processes in the Cell
  - 4.1 ATP/ADP Cycle
  - 4.2 Photosynthesis
    - *4.2.1 Cellular site
    - *4.2.2 Chlorophyll
    - *4.2.3 Substance required
    - 4.2.4 End products
    - +4.2.5 Conditions required
  - 4.3 Cellular Respiration
    - *4.3.1 Definition
    - 4.3.2 Cellular site
    - 4.3.3 Substances required
    - 4.3.4 End products
    - 4.3.5 Occurrence in organisms
  - 4.4 DNA
    - *4.4.1 Function
    - 4.4.2 Structure
    - 4.4.3 Replication
  - 4.5 Protein Synthesis
    - 4.5.1 Steps
    - 4.5.2 RNA
    - 4.5.3 Site

- 5.0 Reproduction & Genetics
  - *5.1 Mitosis
  - 5.2 Meiosis
  - 5.3 Asexual, Sexual Reproduction
    - 5.3.1 Comparison
    - *5.3.2 Examples of asexual
    - *5.3.3 Examples of sexual
    - *5.3.4 Basic terms
  - 5.4 Basic Genetic Terms
  - *5.5 Mendel's Contribution
  - *5.6 Monohybrid Cross
    - 5.6.1 Phenotype ratio
    - 5.6.2 Recessive & dominant traits

* Indicates Minimum Level Skills
+ Indicates laboratory skills

BIOLOGY I

- 5.6.3 Genotypes of individuals
- 5.6.4 Punnett Square
- 5.6.5 Parent genotype
- 5.7 Additional Crosses
- *5.8 Sex-Linked Traits
- 5.9 Hereditary Diseases
- 5.10 Population Genetics
  - 5.10.1 Gene frequency
  - *5.10.2 Mutation
  - 5.10.3 Natural selection

6.0 Systems for Maintainence & Growth in Organisms

- *6.1 Functions of Systems
- 6.2 Digestion
  - *6.2.1 Function of organs
  - *6.2.2 Digestive secretions
  - *6.2.3 Beginning of digestion
  - *6.2.4 Absorbtion
  - 6.2.5 Mechanical & Chemical
- 6.3 Transport
  - 6.3.1 Importance
  - 6.3.2 Plants
  - *6.3.3 Open & closed circulation
  - *6.3.4 Heart Structure
  - *6.3.5 Vertebrate hearts
  - *6.3.6 Blood vessels
  - *6.3.7 Blood function
- 6.4 Gas Exchange
  - 6.4.1 Plants
  - *6.4.2 Cellular respiration
  - *6.4.3 Lower animals
  - *6.4.4 Lungs
  - 6.4.5 Breathing action
- 6.5 Excretion
  - 6.5.1 Definition
  - 6.5.2 Organs
  - 6.5.3 Kidney
- 6.6 Support
  - 6.6.1 Plants
  - 6.6.2 Function of skeleton
  - 6.6.3 Exo- & endo- skeletons
  - 6.6.4 Humans
- 6.7 Locomotion
  - 6.7.1 Structures in protists
  - 6.7.2 Human muscles
  - 6.7.3 Joints
- 6.8 Nervous Control
  - 6.8.1 Function
  - 6.8.2 Brain
  - 6.8.3 Nerve impulse
  - +6.8.4 Senses
- 6.9 Behavior Control
  - 6.9.1 Hormone functions
  - 6.9.2 Plant tropisms
  - 6.9.3 Human endocrine glands
  - 6.9.4 Innate & learned behavior

7.0 Classification & Taxonomy

- 7.1 Characteristics of Classification
- 7.2 Species
- 7.3 Kingdoms
- +7.4 Classification Key

8.0 Ecological Relationships

- 8.1 Ecosystem
- 8.2 Biogeochemical Cycles
- 8.3 Population Ecology
- 8.4 Energy Relationships
- 8.5 Human Effects

9.0 Microorganisms & Disease

- 9.1 Viruses
- 9.2 Bacteria & Humans
- 9.3 Diseases
- 9.4 Body Defenses

PERFORMANCE OBJECTIVES
BIOLOGY I

To demonstrate the ability to recall and apply knowledge of research skills, basic biochemistry, the cell and its environment, processes in the cell, reproduction and genetics, systems for maintainence and growth in organisms, classification and taxonomy, ecological relationships, and microorganisms and disease; students will master the performance objectives listed below. Successful completion of this course is based on teacher judgement and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 Research Skills

1.1 To demonstrate knowledge of the scientific method, students will:

(1) identify, in order, the steps of the scientific method;

(2) identify the control or experimental element in a given experiment; and

*(3) select the best conclusion from a list, based on given data.

1.2 To demonstrate knowledge of data organization, students will:

+(1) record data in a laboratory experiment,

(2) classify statements as observations or assumptions,

+(3) measure length, volume, or mass using standard laboratory apparatus,

(4) locate requested information when given a data chart,

*(5) interpret a bar graph, and

*(6) interpret a line graph.

1.3 To demonstrate knowledge of microscope skills, students will:

*(1) identify parts of a microscope when given a diagram;

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* Indicates Minimum Level Skills
+ Indicates laboratory skills

*(2) identify the function of microscope parts;

*(3) identify the proper method for carrying a microscope,

*(4) calculate the magnification of a microscopic image, and

+(5) set up a slide for proper viewing under a microscope.

2.0 Basic Biochemistry

2.1 Students will identify the location or charge of protons, neutrons, and electrons in an atom.

2.2 Students will recognize that the chemical energy of compounds is located in the bonds.

2.3 To demonstrate knowledge of organic compounds, students will:

*(1) identify the simple sugar most commonly used as an energy source in living cells,

(2) identify the function of fats in living things,

*(3) identify the organic compounds necessary for repair of tissue, and

+(4) determine the presence of starch, reducing sugars, proteins, or fats in at least three common foods.

*2.4 Students will identify the definition of enzymes.

3.0 The Cell and its Environment

*3.1 Students will identify the most basic level of structural organization in living things.

*3.2 Students will recognize a statement of the Cell Theory.

3.3 To demonstrate knowledge of cell structure, students will:

*(1) identify the function of the nucleus, cell wall, cell membrane, or cytoplasm,

(2) identify the function of at least three cell organelles,

*(3) identify the differences between plant and animal cells,

(4) recognize that the structure of a cell is related to its function, and

+(5) locate and identify at least three cell parts on microscope slides.

3.4 To demonstrate knowledge of particle movement, students will:

*(1) identify the definition of diffusion, osmosis, or active transport,

(2) classify examples of diffusion, osmosis, and active transport; and

+(3) observe change in turgor in a laboratory situation.

4.0 Processes in the Cell

4.1 Students will identify the function of ATP in living cells.

4.2 To demonstrate knowledge of photosynthesis, students will:

*(1) identify the site in a cell of photosynthesis,

*(2) identify the role of chlorophyll,

*(3) identify the substances plants require for photosynthesis,

(4) identify the end products of photosynthesis, and

+(5) determine, in the laboratory, at least one condition necessary for photosynthesis.

4.3 To demonstrate knowledge of cellular respiration, students will:

*(1) identify the definition of cellular respiration,

(2) identify the site of respiration in a cell,

(3) identify the substance required by a cell,

(4) identify the end products of respiration, and

(5) recognize that respiration occurs in the cells of almost all organisms.

4.4 To demonstrate knowledge of DNA, students will:

*(1) identify the function of DNA,

(2) describe the structure of DNA, and

(3) identify the definition of replication.

4.5 Students will (1) arrange the steps of protein synthesis in proper order, (2) identify the function of messenger and transfer RNA, and (3) identify the cellular site where proteins are constructed.

5.0 Reproduction and Genetics

*5.1 Students will identify the function of mitosis in single cells, unicellular organisms, or multicellular organisms.

5.2 Students will identify the types of cells resulting from meiosis,

5.3 To demonstrate knowledge of asexual and sexual reproduction, students will:

(1) compare the characteristics of asexual and sexual reproduction in terms of number of parent cells, resemblance of parents to offspring, and organisms in which each occurs;

*(2) identify budding, regeneration, spores, vegetative propagation, or binary fission as examples of asexual reproduction;

*(3) identify gametes, fertilization, conjugation, spawning or pollination as examples of sexual reproduction; and

*(4) identify the definition of egg, sperm, gamete, or zygote.

5.4 Students will identify the definition of basic genetic terms.

*5.5 Students will identify Mendel as the scientist who worked with garden peas and established the basic principles of genetics.

*5.6 To demonstrate knowledge of monohybrid crosses, students will:

(1) predict the phenotype ratio in a simple monohybrid cross,

(2) conclude which trait is recessive or dominant in a monohybrid cross when given the numbers of F_1 phenotypes produced in that cross,

(3) identify the genotype letter pair that represents heterozygous or homozygous individuals, and

(4) predict the F_1 genotype in a monohybrid cross using the Punnett square, and

(5) specify the genotype of both parents in a monohybrid cross when given the dominant and recessive traits and phenotypes of the parents.

5.7 Students will predict the F_1 phenotype in a dihybrid cross, or in a monohybrid cross involving multiple alleles or incomplete dominance.

*5.8 Students will identify hemophilia, color-blindness, or red and white eyes in fruit flies as examples of sex-linked traits.

5.9 Students will identify examples of hereditary diseases.

5.10 To demonstrate knowledge of population genetics, students will:

(1) recognize that, under most conditions, the frequency of a gene in a population does not change;

*(2) identify radiation, chemicals, or temperature as causes of mutation; and

(3) identify a definition of natural selection.

6.0 Systems for Maintenance and Growth in Organisms

*6.1 Students will identify the function of the digestive, respiratory, circulatory, or excretory systems.

6.2 To demonstrate knowledge of the digestive system, students will:

*(1) identify the function of the mouth, esophagus, stomach, intestines, or rectum;

*(2) identify saliva, gastric juices, pancreatic juices, or intestinal juices as digestive secretions,

*(3) identify that digestion begins in the mouth;

*(4) identify the small intestine as the organ in which digested foods are absorbed into the blood, and

(5) identify at least one place in the human body where mechanical or chemical digestion occurs.

6.3 To demonstrate knowledge of transport, students will:

(1) recognize that transport systems are necessary when all cells are not in direct contact with, or close to, the environment;

(2) identify the function of xylem or phloem,

*(3) identify descriptions of open or closed circulatory systems;

*(4) identify the function of the chambers of the heart,

*(5) select an example of an organism with a four-chambered heart,

*(6) identify the function of the arteries, veins, or capillaries; and

*(7) identify the function of blood.

6.4 To demonstrate knowledge of gas exchange, students will:

(1) identify the openings in plants through which gases are exchanged,

*(2) identify the gas produced by cellular respiration and given off by animals,

*(3) identify the function of gills, spiracles, or diffusion in lower animals,

*(4) identify the air sacs as the site of gas exchange in the lungs, and

(5) describe the action of the diaphragm in inhaling and exhaling.

6.5 To demonstrate knowledge of excretion, students will:

(1) identify the definition of excretion,

(2) identify the function of the human kidneys, liver, skin, or lungs, and

(3) identify the nephron as the functional unit of the human kidney.

6.6 To demonstrate knowledge of support in organisms, students will:

(1) identify the part of a plant cell which gives it shape and support,

(2) identify the function of skeletal systems,

(3) name one organism with an exoskeleton and one organism with an endoskeleton, and

(4) identify the function of bone, cartilage, tendons, or ligaments in humans.

6.7 To demonstrate knowledge of locomotion in organisms, students will:

(1) identify that cilia, flagella, or pseudopods are structures of locomotion in the protist kingdom,

(2) identify the function of smooth, striated , or cardiac muscle in humans, and

(3) recognize that skeletal muscles occur in pairs that work together to bend a joint.

6.8 To demonstrate knowledge of nervous control in organisms, students will:

(1) identify the function of a nervous system,

(2) list the cerebellum, cerebrum, and medulla as the main parts of the brain,

(3) identify a definition of a nerve impulse, and

+(4) identify characteristics of at least one human sense in a laboratory situation.

6.9 To demonstrate knowledge of behavior control in organisms, students will:

(1) identify the general function of hormones as chemical regulators of behavior;

(2) list two types of plant tropisms;

(3) identify the function of the pituitary, thyroid, adrenal, ovary or testes in humans; and

(4) list two examples each of innate and learned behavior.

7.0 Classification and Taxonomy

7.1 Students will identify characteristics of classification systems.

7.2 Students will identify a definition of species.

7.3 Students will identify major characteristics of the Plant, Animal, and Protist Kingdoms.

+7.4 Students will use a classification key to identify specimens in the laboratory.

8.0 Ecological Relationships

8.1 Students will identify that ecosystems are composed of biotic and abiotic factors.

8.2 Students will identify that elements are recycled in the carbon, water, or nitrogen biogeochemical cycle.

8.3 Students will list two factors which could increase or decrease population size.

8.4 To demonstrate knowledge of energy relationships, students will:

(1) diagram a food chain from a given list of organisms, and

(2) identify the sun as the original source of energy for life.

8.5 Students will write a short paper discussing some type of pollution as the effects of humans on the environment.

9.0 Microorganisms and Disease

9.1 Students will identify a characteristic of viruses.

9.2 Students will list two examples of beneficial relationships and two harmful relationships of bacteria and humans.

9.3 Students will list four human diseases caused by viruses or bacteria.

9.4 Students will identify at least one body defense mechanism of humans against disease.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	Research Skills	3-5 weeks	MLST	Raymond Oram, et al, *Biology-Living Systems* (Columbus, Ohio: Charles E. Merrill Publishing Company, 1979), pp. 20-37.	James Otto and Albert Towle, *Modern Biology* (New York: Holt, Rinehart, and Winston, 1973), pp. 2-18. *ISIS Resource Units* (Lexington, Mass.: Ginn and Company, 1977), pp. 2-5, 9, 10, 15.
2.0	Basic Biochemistry	2-4 weeks	MLST	Oram, pp. 38-63.	Otto and Towle, pp. 38-56. *ISIS Resource Units*, pp. 22-24.
3.0	Cell and Its Environment	3-5 weeks	MLST	Oram, pp. 64-87.	Otto and Towle, pp. 58-63. *ISIS Resource Units*, pp. 12-13.
4.0	Processes in the Cell	3-5 weeks	MLST	Oram, pp. 60, 88-111, 119, 175-185.	Otto and Towle, pp. 85-115.
5.0	Reproduction and Genetics	4-6 weeks	MLST	Oram, pp. 118-69.	Otto and Towle, pp. 117-218.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
6.0	Systems for Maintenance and Growth in Organisms	5-7 weeks	MLST	Oram, pp. 344-45, 396-539.	Otto and Towle, pp. 281-93, 359-413, 440-508, 523-615, 630-733.
7.0	Classification and Taxonomy	1-2 weeks	MLST	Oram, pp. 288-99.	Otto and Towle, pp. 220-28.
8.0	Ecological Relationships	1-3 weeks	MLST	Oram, pp. 9-11, 556-652.	Otto and Towle, pp. 746-823.
9.0	Microorganisms and Disease	1-3 weeks	MLST	Oram, pp. 300-29.	Otto and Towle, pp. 232-80.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+1.2.1	record data in a laboratory experiment.		Albert Kaskel, et al, Laboratory Biology (Columbus, Ohio: Charles E. Merrill Publishing Company, 1979), pp. 15-20. ISIS Resources Units (Lexington, Mass.: Ginn and Company, 1977), Unit 15.
+1.2.3	measure length, volume, or mass using standard laboratory apparatus.		Kaskel, pp. 21-24. ISIS Resource Units, pp. 2-5, 9, 10.
+1.3.5	set up a slide for proper viewing under a microscope.		Kaskel, pp. 5-14. James Otto, et al, Biology Investigations (New York: Holt, Rinehart, and Winston, Inc., 1973), pp. 5-17.
+2.3.4	determine the presence of starch, reducing sugars, proteins, or fats in at least three common foods.		Kaskel, pp. 31-33, 41-44. Otto, pp. 27-30, 329-31. ISIS, Let's Eat, Activities 2, 18.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+3.3.5	locate and identify at least three cell parts on microscope slides.		Kaskel, pp. 45-54. Otto, pp. 31-38.
+3.4.3	observe change in turgor in a laboratory situation.		Kaskel, pp. 55-63. Otto, pp. 39-52.
+4.2.5	determine in the laboratory at least one condition necessary for photosynthesis.		Kaskel, pp. 85-88, 93-95. Otto, pp. 57-61, 173-75.
+6.8.4	identify characteristics of at least one human sense in a laboratory experiment.		Kaskel, pp, 319-23. Otto, pp. 359-72.
+7.4	use a classification key to identify specimens in the laboratory.		Kaskel, pp. 197-206. Otto, pp. 99-102.

INTRODUCTION
BIOLOGY I, ADVANCED

State Accreditator Number. . 1314
Course Code Number 2303
F.T.E. Category. 1.10
Instructional Level. . . . . Advanced

Report Card Abbreviation . . Biology I, Adv
Length of Course . . . . . . Year
Credit . . . . 1 Science credit
Grade Level. 9, 10, 11, 12

Prerequisites

Department Approval

Textbook(s)

Slesnick, Irwin L., et al, Biology (Glenview, Illinois: Scott, Foresman, 1980).

Notes to Teachers

Biology I, Advanced includes full performance objectives in addition to Minimum Level Skill (MLS) objectives. Students are to develop laboratory skills as well as content knowledge.

The Minimum Level Skills objectives are indicated with an asterisk (*) and will be the only objectives tested on the Minimum Level Skills Test (MLST). The "Teaching Time" listed listed on the "Key to Instructional Materials" is a suggested maximum time for each objective to help insure that all MLS objectives can be met by MLST time.

Laboratory skills are indicated with a plus sign (+). Suggested resources for teaching the laboratory skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources. Supplementary materials listed in keys are in order of preferred use.

Changes have been made in the individual research requirement for this course.

In addition to passing the Minimum Level Skills Test, every student in this course is required to complete and present orally, at least one of the following:

A. Extensive library research

B. Laboratory experimentation

C. Extensive field study or observation

The topic to be investigated may be assigned by the teacher or selected by the student, with teacher approval. This requirement will count at least 1/4 of the grade for the third nine-week grading period. It is recommended that progress be evaluated at least once during each grading period in the first semester to insure that students are proceeding and not procrastinating.

Minimum requirements are suggested as follows:

A. A minimum of 50 hours should be spent in library research, in the field, or in the laboratory.

B. Weekly contact should be maintained between teacher and student regarding progress; students may not contact local agency personnel without teacher assistance and approval.

C. If an extensive library research project is undertaken, students will keep note cards and organize them using an outline. An abstract and bibliography, as well as the note cards and outline, are to be turned in at the time of the oral report.

D. If a laboratory or field study project is done, students will keep a log which will include established and approved procedures and data with conclusions. An abstract and bibliography as well as the log are to be turned in at the time of the oral report.

E. The abstract, outline, and bibliography are to be typed, double spaced. Warriner's English Grammar and Composition: Complete Course, Harcourt, 1977, may be used as a reference.

A guide for each requirement follows:

A. Note Cards (Required for Library Research Project)

As information is gathered, it is to be recorded on index cards. No information should be used in the project which is not on a note card. The student should keep three basic guidelines in mind: (1) no more than one main idea should be recorded on one card; (2) the source of the information, including page numbers, must be on the card; and (3) if the information is quoted directly, quotation marks must be used. The note cards can be shuffled and rearranged as the order of the project content is organized.

B. Log (Required for Laboratory or Field Project)

During investigative experimentation or field study, a dated account of all efforts made during the research, experimentation, observation, or field study is to be kept. It should be noted that a field study with a log constitutes more than a collection with classifications. In an experimental log all data should be recorded and a conclusion or conclusions should be included.

C. Bibliography (Required for All Projects)

The working bibliography is a listing, in the proper bibliographic form, of possible sources of information for the project. It is recommended that this product be done on note cards, with each entry on a separate card. It might be helpful to the student to include the location of each source (school media center, Haydon Burns Library, etc.) on each card. A minimum of ten sources is recommended, of which no more than three may be encyclopedias and at least two of which must be non-book sources (periodicals, pamphlets, audio-visual, interview, etc.). If an additional source is found after the working bibliography is submitted, that source should be approved by the teacher. The final bibliography should be submitted on paper, not note cards.

D. Abstract (Required for All Projects)

An abstract is a summary of the student's project. It is 150-200 words in length. It includes brief statements about what was done, how it was done, what was learned, limitations, and applications of the project.

E. Presentation (Required for All Projects)

The results of every student's project must be presented to an advanced class, entered in the school science fair, or other appropriate presentations. The class presentation should be a minimum of ten minutes and accompanied by visual aids (e.g., posters, films, slides, filmstrips, summary sheet, or chalkboard). These visuals should contain charts, diagrams, or graphs.

Students and teachers desiring further involvement in scientific research should use Performance Objective 13.0 as a guide.

BIOLOGY I, ADVANCED

- 1.0 Research Skills
  - 1.1 Scientific Research Method
    - 1.1.1 Control/Experimental elements
    - *1.1.2 Valid conclusions
  - 1.2 Data Organization
    - *1.2.1 Assumptions/Observations
    - +1.2.2 Measure: metric length, volume, mass
    - 1.2.3 Construction of data charts
  - 1.3 Graph Construction: Bar/Line
  - *1.4 Microscope Skills
    - 1.4.1 Microscope parts
    - 1.4.2 Function of microscope parts
    - 1.4.3 Proper care
    - 1.4.4 Faulty image correction

- 2.0 Basic Biochemistry
  - 2.1 Atomic structure
    - 2.1.1 Fundamental particles
    - 2.1.2 Atomic particles
    - *2.1.3 Structure used in bonding
  - *2.2 Characteristics of Compounds
    - 2.2.1 Bonded unlike elements
    - 2.2.2 Proportion of elements
    - 2.2.3 Change: chemical properties
  - 2.3 Groups of Organic Compounds
    - *2.3.1 Major groups
    - *2.3.2 Element composition
    - *2.3.3 Functions: organic compounds
    - +2.3.4 Examples: foods containing specific organic compounds
  - 2.4 Dehydration Synthesis/Hydrolysis
  - 2.5 Enzymes
    - +2.5.1 Causes: enzyme activity change
    - 2.5.2 Properties: catalysts, enzymes

- 3.0 Cell/Cell Environment
  - *3.1 Levels of Organization
  - 3.2 Life Processes
  - 3.3 Cell Theory
  - 3.4 Cell Structure
    - *3.4.1 Parts /Organelles
    - *3.4.2 Function: structure, organelles
    - *3.4.3 Differences: plant, animal
    - 3.4.4 Structure vs. function
    - +3.4.5 Cell examination
  - 3.5 Homeostasis
  - 3.6 Particle Movement
    - 3.6.1 Definitions
    - 3.6.2 Examples
    - *3.6.3 Direction

- 4.0 Processes in the Cell
  - *4.1 ATP/ADP Cycle
  - 4.2 Photosynthesis/Respiration
    - *4.2.1 Raw materials/End products
    - *4.2.2 Site of reaction
    - 4.2.3 Organisms

* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

BIOLOGY I, ADVANCED

- 4.3 Photosynthesis
  - +4.3.1 Conditions required
  - 4.3.2 Chlorophyll
  - 4.3.3 Light/Dark reactions
  - *4.3.4 Factors affecting rate
- 4.4 Chemosynthesis
- 4.5 Respiration/Fermentation
  - 4.5.1 Respiration
  - 4.5.2 Fermentation
  - 4.5.3 Comparison
- 4.6 Nucleic Acids
  - 4.6.1 Function
  - 4.6.2 Nucleotide structure
  - 4.6.3 DNA/RNA structure
  - *4.6.4 Complementary strands
  - 4.6.5 Replication
- 4.7 Protein Synthesis
  - 4.7.1 Sequenced
  - 4.7.2 RNA types
  - 4.7.3 Translation of codes

5.0 Reproduction/Genetics

- *5.1 Mitosis
  - 5.1.1 Function
  - 5.1.2 Resulting chromosome condition
- *5.2 Meiosis
- 5.3 Asexual/Sexual Reproduction
  - 5.3.1 Advantages
  - 5.3.2 Comparison of offspring
  - *5.3.3 Examples
- 5.4 Genetic Terms: Genotype/Phenotype, Dominant/Recessive/Homozygous/Heterozygous
- 5.5 Mendel's Laws
- *5.6 Monohybrid Crosses
- *5.7 Dihybrid Crosses
- 5.8 Incomplete Dominance/Multiple Alleles
- 5.9 Sex-Linked Traits
  - *5.9.1 Cross of
  - 5.9.2 Sex determination
  - 5.9.3 Examples
- *5.10 Hereditary Diseases
  - 5.10.1 Examples
  - 5.10.2 Mutation: causes
- 5.11 Natural Selection
  - *5.11.1 Theory
  - 5.11.2 Variation/Adaptation/Competition
- 5.12 Darwin/Lamarck

6.0 Systems: Maintenance/Growth in Organisms

- 6.1 Intake/Exchange of Materials
  - *6.1.1 Unicellular organisms
  - 6.1.2 Plants
  - 6.1.3 Humans
- 6.2 Digestion
  - 6.2.1 Intra/Extra-Cellular
  - 6.2.2 Mechanical
  - *6.2.3 Chemical
  - 6.2.4 Function of organs
- 6.3 Vascular Systems
  - 6.3.1 Need for system
  - *6.3.2 Xylem/Phloem
  - *6.3.3 Transpirational pull
  - *6.3.4 Open/Closed
  - *6.3.5 Human blood vessels
  - 6.3.6 Function of blood structures
  - 6.3.7 Lymphatic system
- 6.4 Waste Removal
  - *6.4.1 Excretion/Secretion
  - 6.4.2 Organs in humans
  - 6.4.3 Nephron

BIOLOGY I, ADVANCED

- 6.5 Gas Exchange
  - *6.5.1 Comparison of structures
  - 6.5.2 Stomates
  - *6.5.3 Humans
- +6.6 Vertebrate Dissection
- 6.7 Support/Protection
  - 6.7.1 Skeletal system: function
  - *6.7.2 Plants
  - *6.7.3 Endoskeleton/Exoskeleton
  - 6.7.4 Human
- 6.8 Locomotion
  - 6.8.1 Mechanisms in protists
  - *6.8.2 Human muscle types
  - 6.8.3 Flexor-extensor pairs
- 6.9 Nervous Systems
  - *6.9.1 Nerve cells
  - 6.9.2 Functions of brain parts
  - 6.9.3 Nerve impulse
  - 6.9.4 Reflex arc
  - +6.9.5 Laboratory observation
- 6.10 Behavior Control
  - 6.10.1 Function of hormones
  - *6.10.2 Plant response
  - *6.10.3 Human endocrine glands
  - *6.10.4 Biofeedback
  - 6.10.5 Innate/Learned behavior

7.0 Classification Systems

- 7.1 Characteristics of Systems
- 7.2 Species
- 7.3 Binomial Nomenclature
- 7.4 Characteristics of Kingdoms
- 7.5 Classification Keys

8.0 Ecological Relationships

- 8.1 Biotic/Abiotic Components of Ecosystem
- 8.2 Cycles
- 8.3 Population Dynamics
- 8.4 Food Webs
- 8.5 Symbiotic Relationships
- 8.6 Human Effects on Environment

9.0 Microorganisms/Disease

- 9.1 Viruses
- 9.2 Bacteria
  - 9.2.1 Beneficial/Harmful effects
  - 9.2.2 Structure
- 9.3 Diseases
  - 9.3.1 Examples
  - 9.3.2 Natural defenses
  - 9.3.3 Immunity

PERFORMANCE OBJECTIVES
BIOLOGY I, ADVANCED

To demonstrate the ability to recall and apply knowledge of research skills, basic biochemistry, the cell and its environment, processes in the cell, reporduction and genetics, systems for maintainence and growth in organisms, classification and taxonomy, ecological relationships, and microorganisms and disease, students will master the performance objectives listed below. Successful completion of this course is based on teacher judgement and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 Research Skills

1.1 To demonstrate knowledge of the scientific research method, students will:

(1) suggest the control and experimental elements for a given experiment; and

*(2) draw conclusions when given laboratory data.

1.2 To demonstrate knowledge of data organization, students will:

*(1) identify statements as observations or assumptions;

+(2) measure length, volume, or mass using standard laboratory equipment; and

(3) construct a chart of given laboratory data.

1.3 Students will construct bar graphs and/or line graphs when given laboratory data.

*1.4 To demonstrate knowledge of microscope skills, students will

(1) identify the parts of the microscope on a diagram;

(2) identify the functions of microscope parts;

(3) identify the proper methods of carrying, handling, or cleaning the microscope; and

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* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

(4) identify the steps to be taken to center an image.

2.0 Basic Biochemistry

2.1 To demonstrate knowledge of atomic structure, students will:

(1) identify the fundamental particles of the atom;

(2) identify the location, charge, or relative mass of the fundamental particles of the atoms; and

*(3) identify the particle of the atom involved in the formation of chemical bonds.

*2.2 To demonstrate knowledge of the characteristics of compounds, students will:

(1) identify that compounds are composed of bonded unlike elements;

(2) identify that elements combine in definite proportion, and

(3) identify that chemical properties of the compounds are changed.

2.3 To demonstrate knowledge of groups of organic compounds, students will:

*(1) identify carbohydrates, fats, and proteins as the mauor groups of organic compounds;

*(2) determine whether a given empirical formula could be a carbohydrate, fat, or protein, based on the types of elements and their ratios;

*(3) identify the functions of carbohydrates, fats, or proteins; and

+(4) determine the presence of starch, reducing sugars, protein, or fat in at least four common foods.

2.4 Students will identify the processes of compound formation and compound degradation as dehydration synthesis and hydrolysis.

2.5 To demonstrate knowledge of enzymes, students will:

+(1) determine the effects of temperature, pH, substrate, or concentration change on the activity of an enzyme; and

(2) identify the properties of catalysts or enzymes.

3.0 The Cell and Its Environment

*3.1 Students will arrange the levels of organization within living organisms from simple to complex.

3.2 Students will identify the life processes necessary for the survival of living organisms.

3.3 Students will identify statements of the Cell Theory.

3.4 To demonstrate knowledge of cell structure, students will:

*(1) identify the major cell parts and organelles as the cell wall, cell membrane, nucleus, cytoplasm, chromosome, ribosomes, mitochondria, chloroplast, lysosome, or vacuole;

*(2) identify the functions of the major cell parts and organelles;

*(3) identify structural differences between plant and animal cells;

(4) predict the function of a specialized cell based on the structure of that cell; and

+(5) prepare a microscope slide of cell tissue in which at least three cell parts are identified.

3.5 Students will identify the importance of maintaining homeostasis within the organism.

3.6 To demonstrate knowledge of particle movement, students will:

(1) identify the definition of permeable, turgid, or flaccid;

(2) identify descriptions of examples as being diffusion, osmosis, active transport, plasmolysis, or cytolysis; and

*(3) predict the direction of particle movement through a membrane with unequal concentrations on either side of the membrane.

4.0 Processes in the Cell

*4.1 Students will identify the location of the high energy bond in the ATP molecule.

4.2 To demonstrate knowledge of photosynthesis and respiration, students will:

*(1) identify the raw material or end products of each;

*(2) identify the sites in a cell of these processes; and

(3) identify in what types of organisms they occur.

4.3 To demonstrate knowledge of photosynthesis, students will:

+(1) determine, in the laboratory, at least one condition necessary for efficient photosynthetic reactions;

(2) identify the pigment which absorbs the light energy;

(3) identify the major events of the light and dark reaction; and

*(4) predict the effect of varying light intensities or light color on the rate of photosynthesis.

4.4 Students will identify an example of chemosynthesis.

4.5 To demonstrate knowledge of respiration and fermentation, students will:

(1) identify the major stages of cellular respiration;

(2) identify an example of each of the two major types of fermentation; and

(3) differentiate between respiration and fermentation in terms of the conditions under which each takes place or the amount of energy provided by each.

4.6 To demonstrate knowledge of nucleic acids, students will:

(1) identify the function of nucleic acids;

(2) identify the three components of a nucleotide;

(3) list three differences between DNA and RNA;

*(4) determine the complementary DNA strand or RNA strand that would be formed by a given DNA strand; and

(5) list, in order, the steps of DNA replication.

4.7 To demonstrate knowledge of protein synthesis, students will:

(1) list, in order, the steps of protein synthesis;

(2) identify the function of messenger RNA or transfer RNA; and

(3) determine the transfer RNA anti-codons or coded amino acids (chart provided) for a given messenger RNA strand.

5.0 Reproduction and Genetics

*5.1 To demonstrate knowledge of mitosis, students will:

(1) identify the function of mitotic cell division in unicellular organisms as reproduction, or in a multicellular organism as growth and repair; and

(2) compare the chromosomes in the daughter nuclei which result from mitosis to the original mother cell.

*5.2 Students will compare the chromosome number in the daughter nuclei which result from meiosis to the chromosome number in the original mother cell.

5.3 To demonstrate knowledge of asexual and sexual reproduction, students will:

(1) determine an advantage of sexual reproduction to survival of a species in a given environmental situation;

(2) compare the offspring to the parents in asexual and sexual reproduction; and

*(3) identify examples of sexual and asexual reproduction.

5.4 Students will identify the definitions of basic genetic terms (genotype, phenotype, dominant, recessive, homozygous, and heterozygous).

5.5 Students will identify basic principles of Mendelian genetics.

*5.6 Students will predict the expected genotype or phenotype ratios of offspring in a simple monohybrid cross when given the dominant and recessive traits and the genotypes of the parents.

*5.7 Students will predict the expected phenotype ratio in a dihybrid cross when given the dominant and recessive traits and the genotypes of the parents.

5.8 Students will predict the expected phenotype ratio of offspring in a cross involving incomplete dominance or multiple alleles.

5.9 To demonstrate knowledge of sex-linked traits, students will:

*(1) predict the expected genotype ratio in a cross involving a sex-linked trait when given the genotype of the parents;

(2) identify the sex chromosome combination which determines a normal human male or a normal female; and

(3) identify examples of sex-linked traits.

*5.10 To demonstrate knowledge of hereditary diseases, students will identify:

(1) sickle-cell anemia, Tay-Sachs, or Down's Syndrome as examples of hereditary diseases; and

(2) radiation, chemicals, or temperature as factors which may cause mutations;

5.11 To demonstrate knowledge of natural selection, students will identify:

*(1) a major concept of the theory of natural selection, and

(2) definitions of variation, adaptation, and competition.

5.12 Students will identify statements as being consistent with the views of Darwin or consistent with the views of Lamarck.

6.0 Systems for Maintenance and Growth in Organisms

6.1 To demonstrate knowledge of the intake and exchange of materials, students will identify:

*(1) diffusion, pinocytosis, or active transport as methods of intake in unicellular organisms;

(2) structures in the plant that take in water; and

(3) villi and alveoli as structures in the human body with increased surface areas for the exchange of materials.

6.2 To demonstrate knowledge of digestion, students will:

(1) differentiate between intracellular and extracellular digestion;

(2) identify the function of mechanical digestion or the structures responsible for mechanical digestion;

*(3) determine whether carbohydrates, fats, or proteins would be chemically broken down in the mouth, stomach, or small intestines; and

(4) match the major parts of the human digestive system with their functions.

6.3 To demonstrate knowledge of vascular systems, students will:

(1) determine whether a given organism would require a transport system, based on the size or body plan of that organism;

*(2) identify the major function of xylem and phloem;

*(3) identify transpirational pull as one of the forces by which water moves up a plant;

*(4) differentiate between open and closed circulatory systems;

*(5) identify the functions or characteristics of arteries, veins, or capillaries in humans;

(6) identify the functions of the red cell, white cell, platelets, and plasma in human blood; and

(7) identify the functions of the human lymphatic system.

6.4 To demonstrate knowledge of waste removal, students will:

*(1) differentiate between excretion and secretion;

(2) match the kidney, skin, lungs, or liver with their excretory functions in humans; and

(3) describe the functioning of the human nephron.

6.5 To demonstrate knowledge of gas exchange, students will:

*(1) identify the organisms using spiracles, lungs, or gills for gas exchange;

(2) identify factors which regulate the opening and closing of stomates in plants; and

*(3) identify the function of alveoli in gas exchange for humans.

+6.6 Students will dissect a frog and locate at least eight structures involved in the intake, distribution, or removal of materials.

6.7 To demonstrate knowledge of support and protection, students will:

(1) identify the major function of a skeletal system.

*(2) identify cellulose or the cell wall as giving support to plants;

*(3) identify survival advantages of endoskeletons or exoskeletons; and

(4) differentiate between bone, cartilage, tendon, and ligament in humans.

6.8 To demonstrate knowledge of locomotion, students will:

(1) identify an example of an organism that moves by means of cilia, flagella, or amoeboid movement;

*(2) identify skeletal (striated), smooth, or cardiac muscle in terms of location or voluntary controls in humans; and

(3) describe the way a flexor-extensor muscle pair operates in moving a joint.

6.9 To demonstrate knowledge of nervous systems, students will:

*(1) identify the function of nerve cells;

(2) identify the functions of the cerebrum, cerebellum, and medulla of the human brain;

(3) describe how a nerve impulse travels;

(4) identify a reflex arc; and

+(5) examine nervous system control of animal behavior or human sense organs in a laboratory investigation.

6.10 To demonstrate knowledge of behavior control, students will:

(1) identify the basic function of hormones as chemical regulators;

*(2) predict the growth response in a stem and root when a plant's position or direction of light source is varied;

*(3) identify the human endocrine glands (pituitary, thyroid, adrenal, ovary, or testes);

*(4) identify biofeedback as the effect one hormone may have on another to maintain homeostasis; and

(5) identify examples of animal behavior as innate or learned.

7.0 Classification and Taxonomy

7.1 Students will identify characteristics of classification systems.

7.2 Students will identify the species as the natural basis for biological classification.

7.3 Students will identify an advantage of binomial nomenclature over common names for organisms.

7.4 Students will identify characteristics of organisms belonging to the Plant, Animal, or Protist Kingdom.

7.5 Students will use a classification key for a given set of objects or organisms.

8.0 Ecological Relationships

8.1 Students will identify examples as being abiotic or biotic components of an ecosystem.

8.2 Students will diagram the carbon, water, or nitrogen cycle.

8.3 Students will predict whether a population would tend to increase or decrease under given circumstances.

8.4 Students will diagram a food web for a given set of organisms.

8.5 Students will identify examples as mutualism, commensalism,

8.6 Students will discuss problems concerning human effects on the environment.

9.0 Microorganisms and Disease

9.1 Students will identify the structure of viruses as being a DNA or RNA core and a protein coat.

9.2 To demonstrate knowledge of bacteria, students will:

(1) list at least two examples of beneficial and harmful relationships between bacteria and humans; and

(2) describe the basic structure of a bacterial cell.

9.3 To demonstrate knowledge of diseases, students will:

(1) identify examples of communicable, nutritional, genetic, or degenerative diseases

(2) identify body mechanisms of defense against disease, and

(3) identify the types of immunity, how they are obtained, the quality of protection afforded, and the duration of protection.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	Research Skills	1-2 weeks	MLST		J. Otto and A. Towle, Modern Biology (New York: Holt, Rinehart and Winston, 1973), pp. 8-18. ISIS Resource Units (Lexington, Mass.: Ginn and Company, 1977), Unit 2-5, 9-10, 15.
2.0	Basic Biochemistry	3 weeks	MLST	I. Slesnick, et al, Biology (Glenview, Illinois: Scott Foresman, 1980), pp. 91-95, 538-41.	Otto and Towle, pp. 38-55. ISIS Resource Units, Units 12-24.
3.0	The Cell and Its Environment	3 weeks	MLST	Slesnick, pp. 4, 44, 63-90, 102, 580, 588.	Otto and Towle, pp. 58-83. ISIS Resource Units, Units 12-13.
4.0	Processes in the Cell	5 weeks	MLST	Slesnick, pp. 96-101, 107-19.	Otto and Towle, pp. 85-115.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
5.0	Reproduction and Genetics	8 weeks	MLST	Slesnick, pp. 122-30, 139-80, 217-29, 244, 258, 270, 273, 383, 385, 387.	Otto and Towle, pp. 117-216.
6.0	Systems for Maintenance and Growth in Organisms	10 weeks	MLST	Slesnick, pp. 21, 75, 79, 83-90, 315-16, 325-26, 340-46, 414-415, 420, 428, 433, 456, 460-66, 496, 505-91.	Otto and Towle, pp. 281-93, 359-413, 440-508, 523-615, 630-733.
7.0	Classification and Taxonomy			Slesnick, pp. 15-34.	Otto and Towle, pp. 220-28.
8.0	Ecological Relationships			Slesnick, pp. 243, 620-68.	Otto and Towle, pp. 746-823.
9.0	Microorganisms and Disease			Slesnick, pp. 237-53, 566-71.	Otto and Towle, pp. 232-80.

County Adopted Text:

I. Slesnick, et al, Biology (Glenview, Illinois: Scott, Foresman, 1980).

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
♦1.2.2	measure length, volume, or mass using standard laboratory equipment.		ISIS Resource Units (Lexington, Mass.: Ginn and Company, 1977), Units 5, 9, 10.
♦2.3.4	determine the presence of starch, reducing sugars, protein, or fat in at least four common foods.		A. McCormack, et al, Biology Laboratory Manual (Glenview, Illinois: Scott, Foresman, 1980), pp. 191-94. J. Otto, et al, Biology Investigations (New York: Holt, Rinehart and Winston, 1973), pp. 27-30, 329-31. ISIS, Let's Eat (Lexington, Mass.: Ginn and Company, 1977), Activity 18.
♦2.5.1	determine the effects of temperature, pH, substrate, or concentration change on the activity of an enzyme.		McCormack, pp. 201-06. Otto, pp. 333-36. ISIS, Food and Microorganisms (Lexington, Mass.: Ginn and Company, 1977), Activity 15.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+3.4.5	prepare a microscope slide of a cell tissue in which at least three cell parts are identified.		McCormack, pp. 21-24. Otto, pp. 5-17, 31-38.
+4.3.1	determine, in the laboratory, at least one condition necessary for efficient photosynthetic reactions.		McCormack, pp. 125-28. Otto, pp. 57-61, 173-75.
+6.6	dissect a frog and locate at least eight structures involved in the intake, distribution, or removal of materials.		McCormack, pp. 167-70. Otto, pp. 283-90.
+6.9.5	examine nervous system control of animal behavior or human sense organs in a laboratory investigation.	528	McCormack, pp. 233-36. Otto, pp. 127-29, 355-68.

INTRODUCTION

BIOLOGY II, ADVANCED

State Accreditator Number. . 1321
Course Code Number 2310
F.T.E. Category. 1.1
Instructional Level. . . . . Advanced

Report Card Abbreviation . . Adv Biology 2
Length of Course . . . . . . Year
Credit . . . . 1 Science credit
Grade Level. 11, 12

Prerequisites

Biology I and departmental approval; Chemistry I

Textbook(s)

Kimble, John W., Biology (Reading, Massachusetts: Addison-Wesley, 1978).

Notes to Teachers

Biology II, Advanced performance objectives are based on the Advanced Placement Biology outline published by the College Entrance Examination Board. The course also includes Minimum Level Skills (MLS) objectives. Laboratory experiences will enhance the students' understanding of biological concepts.

The Minimum Level Skills objectives are indicated with an asterisk (*) and will be the only objectives tested on the Minimum Level Skills Test (MLST). The "Teaching Time" listed on the Key to Instructional Materials is a suggested time for each objective to help ensure that all MLS objectives can be met by MLST time.

Laboratory skills are indicated with a plus sign (+). Essential laboratories are indicated with an encircled plus sign ⊕. Suggested resources for teaching the laboratory skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources.

It is highly recommended that Biology II be taught concurrently with Science Research to allow enough time for laboratory activities and to cover all of the content necessary for the Advanced Placement Test.

Supplementary resources such as the Biology Oxford Readers and articles from Scientific American will enhance the students knowledge of the concepts in the text.

The individual research requirement has been dropped from Biology II but should be an integral part of the Science Research course accompanying Biology II.

An order form for AP publications is available from the Science Office, 390-2129. Many useful publications, e.g., Beginning an Advanced Placement in Biology, Grading the Advanced Placement Test in Biology, and The Advanced Placement Examination in Biology can be ordered from the College Entrance Examination Board.

Since the AP examination includes an essay section, it is advisable that students be provided opportunities to demonstrate writing skills. Several objectives in the outline can be mastered by composing essay answers.

Since performance objective 12.1 (2) deals with lowering the birth rate, teachers will need to obtain parental permission for any instruction which deals with contraception. The concept of abortion may not be taught.

BIOLOGY II, ADVANCED

- 1.0 Chemical Basis of Life
  - 1.1 Atoms/Isotopes
    - 1.1.1 Atomic weight/ Atomic number
    - 1.1.2 Subatomic particles
    - 1.1.3 Isotope definition
    - *1.1.4 Tracer isotopes
  - 1.2 Chemical Bonds
  - 1.3 Chemical Reactions/ Equilibria
    - 1.3.1 Chemical/Physical change
    - 1.3.2 Oxidation/ Reduction reaction
    - 1.3.3 Biological oxidation
  - 1.4 Energetics
    - *1.4.1 Free energy
    - 1.4.2 + and — ΔG
    - 1.4.3 Entropy
    - 1.4.4 Entropy/Organism relationship
  - 1.5 Organic Compounds
    - 1.5.1 Structural formulas
    - 1.5.2 Example
    - 1.5.3 Saturated/ Unsaturated fats
    - 1.5.4 Protein structures
    - *1.5.5 Components
    - 1.5.6 Dehydration synthesis/ Hydrolysis
  - 1.6 Enzymes
    - 1.6.1 Activation energy
    - *1.6.2 Lock and key hypothesis
    - 1.6.3 Competitive inhibition
    - 1.6.4 Temperature/pH
    - 1.6.5 Enzyme/Substrate complex
    - 1.6.6 Accessory substances
    - 1.6.7 Precursor activation/ Feedback inhibition
    - ●1.6.8 Enzyme activity
- 2.0 Cells
  - 2.1 Historical Development
  - 2.2 Cell Ultrastructure
    - *2.2.1 Organelle function
    - 2.2.2 Organelle structure
    - 2.2.3 Centrifugation
    - 2.2.4 Biochemistry/ Microscopy
    - 2.2.5 ECF components
    - *2.2.6 Osmosis/Diffusion/ Active transport
    - 2.2.7 Endocytosis/ Exocytosis
    - 2.2.8 Diffusion rate
    - 2.2.9 Virus components
    - 2.2.10 Virus/Host cells
    - *2.2.11 Prokaryote/ Eukaryote
    - ●2.2.12 Animal/Plant cell differences
  - 2.3 Cell Division
    - 2.3.1 Chromosomes
    - 2.3.2 Mitosis
    - 2.3.3 Meiosis events
    - *2.3.4 Meiosis significance
- 3.0 Energy Transformations
  - 3.1 Respiration: Aerobic/ Anaerobic
    - 3.1.1 Anabolism/ Catabolism
    - *3.1.2 ATP
    - 3.1.3 Krebs cycle
    - 3.1.4 Electron transport system
    - *3.1.5 Oxygen
    - 3.1.6 Glycolysis
    - 3.1.7 Fermentation

* Indicates Minimum Level Skills
+ Indicates Recommended Laboratory Activities
● Indicates Essential Laboratory Activities

BIOLOGY II, ADVANCED

- *3.1.8 Mitochondrion
- 3.1.9 Respiration control
- 3.1.10 Fat/Protein/Carbohydrate metabolism
- 3.1.11 Respiration rate
- ●3.1.12 CO_2 production

- 3.2 Photosynthesis
  - 3.2.1 Early experiments
  - *3.2.2 Photosynthesis rate
  - 3.2.3 Spectrum: action/absorption
  - 3.2.4 Dark reactions
  - 3.2.5 Pigments
  - 3.2.6 Photosystem I, II
  - 3.2.7 C_3 / C_4 pathways
  - 3.2.8 Photosynthesis/Respiration differences

4.0 Genetics

- 4.1 Watson-Crick DNA Model
- 4.2 DNA Replication
  - 4.2.1 Process
  - 4.2.2 DNA polymerase
  - 4.2.3 Meselson/Stahl
  - 4.2.4 Semi-conservative replication
- 4.3 Genetic Code/Mutation
  - *4.3.1 Point mutations
  - 4.3.2 Mutagenic agents
  - 4.3.3 One gene-one enzyme theory
  - *4.3.4 Codon
  - 4.3.5 Code verification
- 4.4 Protein Synthesis
  - 4.4.1 RNA
  - *4.4.2 Transcription
  - *4.4.3 Translation
- 4.5 Genetic Engineering
  - 4.5.1 Reverse transcriptase
  - 4.5.2 Plasmids
- 4.6 Gene Regulation
  - 4.6.1 Modulation
  - 4.6.2 Jacob-Monad
  - *4.6.3 Operon
- 4.7 Transformation
- *4.8 Mendel's Laws
- 4.9 Probability
- 4.10 Inheritance: Chromosomal Basis
  - 4.10.1 Genes/Chromosomes
  - 4.10.2 Sex determination
  - *4.10.3 Nondisjunction
  - 4.10.4 Chromosomal abnormalities
- 4.11 Linkage
  - *4.11.1 Definition
  - 4.11.2 Linkage map
- 4.12 Sex-Linked Inheritance
  - 4.12.1 Males/Females
  - 4.12.2 X inactivation
  - *4.12.3 Examples
- 4.13 Polygenic Inheritance
- 4.14 Multiple Alleles
  - 4.14.1 Description
  - 4.14.2 Blood groups
- ●4.15 *Drosophila* Traits

5.0 Plant Structure/Function

- 5.1 Plant Organs
  - *5.1.1 Function
  - 5.1.2 Tissues
  - 5.1.3 Dicot root
  - 5.1.4 Stems
  - 5.1.5 Leaf structures
  - ●5.1.6 Investigation
- 5.2 Absorption: Water/Minerals
  - 5.2.1 Water: path
  - *5.2.2 Xylem
  - *5.2.3 Factors affecting transpiration
  - 5.2.4 Transport theories

BIOLOGY II, ADVANCED

- 5.3 Food Translocation
  - *5.3.1 Phloem
  - 5.3.2 Biochemical/ Physical pathways
  - 5.3.3 Pressure flow theory
  - 5.3.4 Factors affecting translocation

- 6.0 Plant Reproduction/Development
  - 6.1 Generation Alternation
    - *6.1.1 Gametophyte/ Sporophyte
    - 6.1.2 Reproductive structures
  - 6.2 Life Cycles
  - 6.3 Seed Structure/ Germination
    - 6.3.1 Seed parts
    - *6.3.2 Germination conditions
    - 6.3.3 Fruit adaptations
  - 6.4 Growth/Development
    - 6.4.1 Nastic movement/ Tropisms
    - 6.4.2 Geotropism/ Phototropism
    - *6.4.3 Auxin
    - 6.4.4 Coordination
    - 6.4.5 Gibberellins/ Cytokinins/ Abscisic acid
    - ●6.4.6 Plant growth
  - 6.5 Photoperiodism
    - *6.5.1 Flowering
    - 6.5.2 Mechanism
    - 6.5.3 Phytochrome

- 7.0 Animal Structure/Function
  - 7.1 Major Systems
    - 7.1.1 Digestion: intracellular, extracellular
    - *7.1.2 Digestive organ functions
    - 7.1.3 Air path: humans
    - 7.1.4 Gas exchange: vertebrates
    - 7.1.5 Circulation patterns: vertebrates
    - *7.1.6 Blood function
    - ●7.1.7 Exercise
    - +7.1.8 Blood characteristics
    - 7.1.9 Nephron: structure function
    - *7.1.10 Nitrogenous wastes
    - *7.1.11 Muscle types
    - 7.1.12 Sliding-filament theory
    - 7.1.13 Neuron: structure function
    - 7.1.14 Brain parts/ Spinal cord
    - 7.1.15 Endocrine glands
    - +7.1.16 Vertebrate dissection
  - 7.2 Homeostatic Mechanisms
    - 7.2.1 Hormones
    - 7.2.2 Hormonal action mechanisms
    - *7.2.3 Autonomic nervous system subdivisions
    - 7.2.4 Nervous system control
  - 7.3 Reproduction: Hormones
    - 7.3.1 Gamete production
    - 7.3.2 Uterine changes

- 8.0 Animal Reproduction/Development
  - 8.1 Gamete Formation/ Fertilization
    - 8.1.1 Formation: egg, sperm
    - *8.1.2 Oogenesis/ Spermatogenesis
    - 8.1.3 Fertilization events
    - *8.1.4 Fertilization location

COURSE OUTLINE

BIOLOGY II, ADVANCED

- 8.2 Embryology
  - *8.2.1 Cleavage
  - 8.2.2 Gastrulation
  - 8.2.3 Germ layers
  - 8.2.4 Differentiation
- 8.3 Induction
  - *8.3.1 Definition
  - 8.3.2 Theoretical experiments
  - 8.3.3 Inhibition

9.0 Origin of Life/Evolution

- 9.1 Early Theories
  - 9.1.1 Creationism/ Science
  - 9.1.2 Cosmozoa theory
  - 9.1.3 Spontaneous generation
- 9.2 Modern Theories
  - 9.2.1 Oparin
  - 9.2.2 Miller
  - 9.2.3 Autotrophy/ Heterotrophy
- 9.3 Evolution
  - 9.3.1 Evidence
  - 9.3.2 Lamarck
  - 9.3.3 Darwin
- 9.4 Natural Selection
  - 9.4.1 Processes
  - *9.4.2 Variability
  - 9.4.3 Hardy-Weinberg law
  - *9.4.4 Law conditions
  - 9.4.5 Balanced polymorphism
  - *9.4.6 Isolation
- *9.5 Adaptive Radiation
- 9.6 Evolutionary Diversity
  - 9.6.1 Invertebrates/ Verterbrates
  - 9.6.2 Plants
  - 9.6.3 Homology/Analogy
  - 9.6.4 Convergence
  - 9.6.5 Extinction
- 9.7 Classification
  - 9.7.1 Criteria
  - +9.7.2 Taxonomic key
- 9.8 Human Evolution

10.0 Ecology

- 10.1 Energy Flow/Productivity
  - *10.1.1 Ecosystem
  - *10.1.2 Trophic levels
  - 10.1.3 Food chain/ Food web
  - 10.1.4 Pyramids
  - 10.1.5 Biomass
  - 10.1.6 Ecosystem productivity
- 10.2 Biogeochemical Cycles
  - 10.2.1 Carbon cycle
  - 10.2.2 Oxygen cycle
  - *10.2.3 Bacteria
  - 10.2.4 Nitrification/ Denitrification
  - 10.2.5 Phosphorous cycle
  - 10.2.6 Phosphorus importance
- 10.3 Population Growth
  - 10.3.1 Population growth curves
  - *10.3.2 Carrying capacity
  - 10.3.3 R / K strategists
- 10.4 Community Structure
  - 10.4.1 Plant succession
  - 10.4.2 Climax community
  - 10.4.3 Biomes
- 10.5 Habitats
  - *10.5.1 Abiotic factors
  - 10.5.2 Interspecific competition
  - 10.5.3 Predation
  - 10.5.4 Interactions

11.0 Behavior

- 11.1 Stereotyped/Learned
  - 11.1.1 Innate/Learned
  - 11.1.2 Tropisms/Taxes
  - 11.1.3 Knee-jerk reflex
  - 11.1.4 Habituation/ Imprinting/ Conditioned response
- 11.2 Rhythmic Behavior/ Biological Clocks

COURSE OUTLINE

BIOLOGY II, ADVANCED

- 11.3 Societal Behavior
- 11.4 Social Behavior
    - 11.4.1 Communication
    - 11.4.2 Pheremones/Visual signals
    - 11.4.3 Dominance hierarchy
    - 11.4.4 Territoriality
    - 11.4.5 Aggressive behavior
    - 11.4.6 Courtship behavior

12.0 Social Biology

- 12.1 Human Population Growth
    - 12.1.1 Past vs. present
    - 12.1.2 Birth rate
- 12.2 Man's Role in Nature
    - 12.2.1 Conservation
    - 12.2.2 Pollution
- 12.3 Bacteria/Algae/Fungi: Economic Aspects
    - 12.3.1 Importance
    - 12.3.2 Uses
- +12.4 Bacteriological Laboratory Techniques
- 12.5 Biomedical Progress
    - 12.5.1 Reproductive engineering
    - 12.5.2 Genetic engineering: positive, negative aspects

PERFORMANCE OBJECTIVES
BIOLOGY II, ADVANCED

To demonstrate the ability to recall and apply knowledge of the chemical basis of life, the cell, energy transformations, plant structure and function, plant reproduction and development, animal structure and function, animal reproduction and development, origin of life and evolution, ecology, behavior, and social biology, students will master the performance objectives listed below. Successful completion of this course is based on teacher judgment and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 Chemical Basis of Life

1.1 To demonstrate knowledge of atoms and isotopes, students will:

(1) distinguish between atomic weight and atomic number;

(2) identify the electrical charges and masses of the subatomic particles;

(3) identify isotopes as atoms of the same element that differ in atomic weight; and

*(4) identify the use of carbon 14 as a tracer in investigating biochemical processes.

1.2 To demonstrate knowledge of chemical bonds, students will discuss hydrogen, ionic, and covalent bonds.

1.3 To demonstrate knowledge of chemical reactions and equilibria, students will:

(1) distinguish between a chemical and physical change;

(2) distinguish between an oxidation and reduction reaction; and

(3) state that the removal of hydrogen is the most common kind of biological oxidation.

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* Indicates Minimum Level Skills
+ Indicates Recommended Laboratory Activities
● Indicates Essential Laboratory Activities

1.4 To demonstrate knowledge of energetics, students will:

*(1) identify free energy as energy that can be harnessed to do work;

(2) explain the significance of a positive or negative free energy change;

(3) identify entropy as the state of disorder or randomness in a system; and

(4) explain the relationship between entropy and living organisms.

1.5 To demonstrate knowledge of the structure and function of organic compounds, students will:

(1) identify the structural formulas of a carbohydrate, lipid, protein, organic acid, and nucleic acid;

(2) identify an example of a carbohydrate, lipid, protein, and nucleic acid;

(3) distinguish between saturated and unsaturated fats;

(4) describe the primary, secondary, tertiary, and quatenary structure of proteins;

*(5) identify the monomers of DNA, RNA, proteins, or polysaccharides, and

(6) distinguish between dehydration synthesis and hydrolysis.

1.6 To demonstrate knowledge of enzymes, students will:

(1) state the importance of energy of activation in the context of chemical reactions;

*(2) identify the lock and key hypothesis as an explanation of enzyme-substrate specificity;

(3) explain the phenomenon of competitive inhibition;

(4) list the reasons enzymes are sensitive to pH changes and temperature;

(5) identify three ways enzymes may be bonded to substrates as hydrogen bonds, ionic bonds, and attraction of hydrophobic regions of two molecules;

(6) discuss the roles of coenzymes, inorganic cofactors, prosthetic groups, and vitamins as accessory substances;

(7) identify precursor activation and feedback inhibition as two homeostatic mechanisms that regulate metabolite concentrations within a cell; and

*(8) investigate the effect of temperature on enzyme activity.

2.0 Cells

2.1 Students will trace the historical development of the cell concept.

2.2 To demonstrate knowledge of cell ultrastructure, students will:

*(1) identify the function of the cell membrane, nucleolus chloroplast, endoplasmic reticulum, peroxisome, ribosome, mitochondrion, Golgi apparatus, lysosome, microtubule, cell wall, or vacuole;

(2) describe the structure of the major cell organelles;

(3) discuss how centrifugation is used to separate the parts of the cell;

(4) explain how techniques of biochemistry and microscopy are used to study the structure of cell parts;

(5) identify gases, inorganic ions, foods, vitamins, and hormones as major components of extracellular fluid;

*(6) identify a definition of osmosis, diffusion, or active transport;

(7) compare endocytosis and exocytosis;

(8) identify concentration gradient, size, charge, and lipid solubility as factors which affect the rate of diffusion through a cell membrane;

(9) identify nucleic acid core and protein coat as two major components of viruses;

(10) describe the relationship between viruses and host cells;

*(11) identify a definition of a prokaryote or eukaryote; and

*(12) investigate the differences between plant and animal cells using light microscopy.

2.3 To demonstrate knowledge of cell division, students will:

(1) identify chromosomes as elongated structures in the nucleus containing DNA and histone protein;

(2) trace the events of the stages of mitosis in plants and animals;

(3) discuss the events of the stages of meiosis in cells of plants or animals; and

*(4) identify the significance of meiosis as reducing the number of chromosomes from the diploid number to the haploid number and providing for variation in gametes.

3.0 Energy Transformations

3.1 To demonstrate knowledge of aerobic and anaerobic respiration, students will:

(1) compare anabolism and catabolism;

*(2) identify ribose, adenine, and three phosphate groups as the major components of ATP;

(3) trace the pathway of cellular respiration;

(4) discuss the electron transport system in terms of redox substances and ATP formation;

*(5) identify oxygen as the final acceptor of electrons in the respiratory chain;

(6) list the steps of glycolysis;

(7) compare lactic acid fermentation with alcoholic fermentation;

*(8) identify the mitochondrion as the place where most respiratory enzymes are found in eukaryotes;

(9) identify examples of feedback inhibition in the control of cellular respiration;

(10) discuss the interconnections between fat, protein, and carbohydrate metabolism;

(11) identify the factors affecting the rate of respiration; and

●(12) investigate the production of CO_2 by living organisms.

3.2 To demonstrate knowledge of photosynthesis, students will:

(1) identify the contributions of van Helmont, Priestley, Ingen-Housz, Englemann, Blackman, Calvin, and Van Niel;

*(2) identify light intensity, temperature, and carbon dioxide concentration as factors which affect the rate of photosynthesis;

(3) compare an action spectrum and absorption spectrum;

(4) trace the pathway of carbon dioxide fixation in photosynthesis;

(5) identify the roles of plant pigments in reacting to light energy;

(6) summarize the principle reactions in Photosystem I and Photosystem II;

(7) compare C_3 and C_4 pathways; and

(8) contrast photosynthesis and cell respiration in terms of electron transport and energy.

4.0 Genetics

4.1 To demonstrate knowledge of the Watson-Crick model of DNA, students will diagram the basic structure of DNA labeling the sugar, phosphate, and nitrogen bases.

4.2 To demonstrate knowledge of DNA replication, students will:

(1) describe DNA replication;

(2) identify DNA polymerase as an enzyme that catalyzes the linking together of DNA nucleotides during replication;

(3) describe the experiment of Meselson and Stahl; and

(4) identify semi-conservative replication as the way DNA duplicates.

4.3 To demonstrate knowledge of the genetic code and the chemical nature of mutation, students will:

*(1) identify point mutations as changes in the sequence of bases of the DNA molecule;

(2) identify radiation and certain chemicals as mutagenic agents;

(3) describe Beadle and Tatum's one gene-one enzyme theory;

*(4) identify a codon as a triplet of nitrogen bases in the DNA or RNA molecule; and

(5) discuss the research that led to the verification of the genetic code.

4.4 To demonstrate knowledge of protein synthesis, students will:

(1) distinguish between ribosomal, transfer, and messenger RNA;

*(2) identify transcription as the synthesis of a molecule of RNA complementary to a strand of DNA; and

*(3) identify translation as the synthesis of a polypeptide from the information encoded in a messenger RNA molecule.

4.5 To demonstrate knowledge of genetic engineering techniques, students will:

(1) identify the role of reverse transcriptase; and

(2) describe the way in which foreign DNA may be inserted into the plasmid of a bacterial cell.

4.6 To demonstrate knowledge of gene regulation, students will:

(1) identify modulation as the turning on and off of genetic information within a cell in response to changes in its environment;

(2) discuss the Jacob-Monad hypothesis of gene control; and

*(3) identify the function of a structural gene, an operator gene or a regulator gene in an operon.

4.7 To demonstrate knowledge of transformation, students will discuss the experiments of Griffith and Avery.

*4.8 Students will identify a description of Mendel's law of dominance, segregation, or independent assortment.

4.9 Students will demonstrate the use of probability in solving genetics problems.

4.10 To demonstrate knowledge of the chromosomal basis of inheritance, students will:

(1) summarize the parallelism between the behavior of genes as described by Mendel and the behavior of chromosomes in meiosis and fertilization;

(2) compare sex determination in Drosophila and humans;

*(3) identify nondisjunction as the cause of Down's Syndrome or Klinefelter's Syndrome; and

(4) differentiate between chromosomal deletions, translocations, and inversions.

4.11 To demonstrate knowledge of linkage, students will:

*(1) identify linkage as the tendency of two genes to be inherited together because they are located on the same chromosome; and

(2) plot a linkage map when given percentages of recombinant offspring.

4.12 To demonstrate knowledge of sex-linked inheritance, students will:

(1) discuss the tendency for males to inherit sex-linked traits more frequently than females;

(2) describe inactivation of the X chromosome resulting in the Barr body; and

*(3) identify hemophilia and red-green color blindness as examples of sex-linked traits.

4.13 Students will identify the continuous variation of height and skin color as examples of polygenic inheritance.

4.14 To demonstrate knowledge of multiple alleles, students will:

(1) identify a description of a multiple allele; and

(2) discuss the inheritance of the human blood groups.

● 4.15 Students will investigate the inheritance of a selected trait using Drosophila.

5.0 Plant Structure/Function

5.1 To demonstrate knowledge of plant organs, students will:

*(1) identify the function of the root, stem, leaf, flower, seed, or fruit;

(2) describe the function of meristematic, protective, parenchyma, collenchyma, and sclerenchyma tissues;

(3) identify from a diagram of a dicot root the function of epidermis, cortex, pericycle, root hair, xylem, and phloem;

(4) compare the structures found in a woody dicot stem, herbaceous dicot stem, and monocot stem;

(5) identify from a diagram of a typical leaf the location of guard cell, stomate, palisade layer, spongy layer, upper epidermis, and lower epidermis; and

●(6) investigate the structure of a root, stem, leaf, flower, fruit, or seed.

5.2 To demonstrate knowledge of water and mineral absorption and transport, students will:

(1) trace the path taken by a molecule of water from the time it enters a plant until the time it leaves the plant by transpiration;

*(2) identify xylem as being made of nonliving vessels which transport water upward in plants;

*(3) identify the effect of light, temperature, humidity, wind, or soil water upon the rate of transpiration; and

(4) discuss the theories of water transport in plants.

5.3 To demonstrate knowledge of food translocation, students will:

*(1) identify phloem as composed of sieve tubes which translocate plant products;

(2) trace the biochemical and physical pathways of a product that originated in the leaf but ends up as starch stored in a root;

(3) discuss the pressure flow theory of translocation; and

(4) describe the effect of temperature and oxygen upon the rate of translocation.

6.0 Plant Reproduction/Development

6.1 To demonstrate knowledge of alternation of generations, students will:

*(1) identify the definitions of the gametophyte or sporophyte generations in plants; and

(2) identify the functions of the rhizome, archegonia, prothallus, antheridia, sporangia, megaspore, microspore, and protonema.

6.2 Students will discuss the life cycles of the moss, fern, typical gymnosperm, and typical angiosperm.

6.3 To demonstrate knowledge of seed structure and germination, students will:

(1) identify the function of the plumule, hypocotyl, radicle, and cotyledon;

*(2) identify temperature, oxygen, and moisture as conditions necessary for germination to occur; and

(3) observe various fruit adaptations which aid in seed dispersal.

6.4 To demonstrate knowledge of growth and development, students will:

(1) differentiate between nastic movements and tropisms;

(2) differentiate between geotropism and phototropism;

*(3) identify unequal distribution of auxin as resulting in the bending of plant stems and roots;

(4) discuss ways in which auxins participate in the coordination of plant activities;

(5) contrast the roles of gibberellins, cytokinins, and abscisic acid in the growth and development of plants; and

●(6) investigate the effect of environmental or chemical influences on plant growth.

6.5 To demonstrate knowledge of photoperiodism, students will:

*(1) identify photoperiodism as an environmental factor that initiates flowering;

(2) discuss the mechanism of photoperiodism in short-day and long-day plants; and

(3) explain the role of phytochrome in photoperiodism.

7.0 Animal Structure/Function

7.1 To demonstrate knowledge of the major systems of animals, students will:

(1) distinguish between intracellular and extracellular digestion;

*(2) identify the functions of the stomach, pancreas, small intestine, large intestine, or liver in digestion;

(3) trace the pathway in humans taken by a molecule of oxygen from the time it enters a nostril until it reaches a red blood cell;

(4) compare gas exchange in fish, amphibians, reptiles, birds, and mammals;

(5) compare circulation patterns in amphibians, reptiles, and mammals;

*(6) identify two functions of blood as transport and defense against disease;

●(7) investigate the effects of exercise on pulse rate, breathing rate, or blood pressure;

+(8) investigate the characteristics of human blood using such techniques as typing and Wright's stain;

(9) describe the structure and function of the nephron;

*(10) identify ammonia, uric acid, and urea as the common nitrogenous wastes by vertebrates;

*(11) identify cardiac, smooth, and skeletal as three different kinds of muscles found in vertebrates;

(12) explain the sliding-filament theory of muscle contraction;

(13) describe the structure and function of a neuron;

(14) identify the functions of the parts of the brain and spinal cord;

(15) identify the functions of the thyroid, parathyroid, pituitary, and adrenal glands; and

+(16) perform a vertebrate dissection to identify the major organs of the digestive, respiratory, excretory, nervous, and circulatory systems.

7.2 To demonstrate knowledge of homeostatic mechanisms, students will:

(1) describe the role of hormones in maintaining homeostasis in the body;

(2) explain the mechanisms of hormonal action;

*(3) identify the subdivisions of the autonomic nervous system as the sympathetic and parasympathetic; and

(4) describe the role of the nervous system in controlling homeostasis.

7.3 To demonstrate knowledge of hormones in reproduction, students will:

(1) discuss the roles of hormones in gamete production of males and females; and

(2) explain how hormones control uterine changes in the female reproductive cycle.

8.0 Animal Reproduction and Development

8.1 To demonstrate knowledge of gamete formation and fertilization, students will:

(1) describe the steps leading to mature egg and sperm formation;

*(2) identify the organ in which spermatogenesis or oogenesis occurs in mammals;

(3) describe the fertilization of an egg by a sperm; and

*(4) identify the fallopian tubes as the location of fertilization in mammals.

8.2 To demonstrate knowledge of embryology, students will:

*(1) identify cleavage as a stage of development in which the zygote starts a series of mitotic divisions;

(2) identify gastrulation as a stage of development in which the germ layers are formed;

(3) list the organs or tissues derived from each of the three germ layers; and

(4) discuss the evidence that differentiating cells retain the same DNA as the original cell.

8.3 To demonstrate knowledge of induction, students will:

*(1) identify embryonic induction as one tissue directing the differentiation of another;

(2) discuss the experiments which led to the theory of induction; and

(3) discuss the role of inhibition in differentiation.

9.0 Origin and Evolution of Life

9.1 To demonstrate knowledge of the early theories of the origin of life, students will:

(1) differentiate between attempts to account for the origin of life on a scientific basis as opposed to those based on creationism;

(2) describe the cosmozoa theory; and

(3) discuss the experiments of van Helmont, Redi, Spallanzani, and Pasteur in relation to the theory of spontaneous generation.

9.2 To demonstrate knowledge of the modern theories of the origin of life, students will:

(1) discuss the essence of Oparin's theory;

(2) describe Miller's apparatus to produce organic molecules; and

(3) distinguish heterotrophy from autotrophy.

9.3 To demonstrate knowledge of the theories of evolution, students will:

(1) state that observations from paleontology, comparative anatomy, embryology, and biochemistry provide evidence for evolution;

(2) identify a description of Lamarck's theory of acquired characteristics; and

(3) reconstruct the logical process by which Darwin arrived at the theory of natural selection.

9.4 To demonstrate knowledge of modern concepts of natural selection students will:

(1) identify the processes involved in natural selection;

*(2) identify mutation, crossing over, and random assortment, as genetic sources of variability;

(3) identify a statement of the Hardy-Weinberg law;

*(4) identify the conditions under which the Hardy-Weinberg law fails to operate as mutation, genetic drift, and nonrandom mating;

(5) identify balanced polymorphism as the maintenance by natural selection of two or more distinct phenotypes in a population; and

*(6) identify isolation as a requirement for speciation.

*9.5 Students will identify adaptive radiation as the production of diverse species from a single ancestral one.

9.6 To demonstrate knowledge of evolutionary diversity, students will:

(1) trace the evolutionary path of invertebrates and vertebrates;

(2) discuss the evolution of the major plant groups;

(3) distinguish between homology and analogy;

(4) identify convergence as the evolution of similar traits in unrelated organisms; and

(5) discuss the relationship of extinction to evolution.

9.7 To demonstrate knowledge of classification, students will:

(1) contrast the criteria used by early systems to those of modern day systems; and

+(2) develop a taxonomic key to classify selected organisms.

9.8 Students will trace the major evolutionary events which led to the appearance of modern man.

10.0 Ecology

10.1 To demonstrate knowledge of energy flow and productivity in ecosystems, students will:

*(1) identify an ecosystem as a community of organisms interacting with each other and their non-living surroundings;

*(2) identify energy as being lost each time it is transferred from one trophic level to the next;

(3) contrast a food chain and food web;

(4) discuss the arrangement of trophic levels regarding the pyramid of numbers and energy;

(5) identify biomass as the total organic matter present in an ecosystem; and

(6) explain how ecosystem productivity is determined.

10.2 To demonstrate knowledge of biogeochemical cycles, students will:

(1) trace the path of carbon through the carbon cycle;

(2) discuss the interaction of photosynthesis and respiration in the oxygen cycle;

*(3) identify bacteria as essential to the nitrogen cycle;

(4) discuss nitrification and denitrification;

(5) describe the phosphorous cycle; and

(6) explain the importance of phosphorous to living organisms.

10.3 To demonstrate knowledge of the growth of populations, students will:

(1) discuss representative population growth curves;

*(2) identify carrying capacity as the maximum number of individuals supported by the environment; and

(3) compare and contrast r strategists and K strategists.

10.4 To demonstrate knowledge of community structure, growth, and regulation, students will:

(1) discuss the mechanism involved in plant succession;

(2) identify the climax community as being the end product of succession; and

(3) list the characteristics and examples of each of the major biomes.

10.5 To demonstrate knowledge of habitats, students will:

*(1) identify abiotic factors as water, soil, air, and light;

(2) give examples of interspecific competition;

(3) discuss ways in which animals have adapted to minimize their role as prey in the predator-prey relationship;

(4) compare and contrast mutualism, commensalism, and parasitism.

11.0 Behavior

11.1 To demonstrate knowledge of stereotyped and learned behavior, students will:

(1) distinguish between innate and learned behavior;

(2) differentiate between tropisms and taxes;

(3) describe the mechanism of the knee-jerk reflex; and

(4) distinguish between habituation, imprinting, and conditioned response.

11.2 Students will discuss examples of rhythmic behavior and biological clocks in living organisms.

11.3 Students will explain how societal behavior is exhibited by ants, bees, birds, and primates.

11.4 To demonstrate knowledge of social behavior, students will:

(1) describe the manner of communication among honey bees as observed by Karl von Frisch;

(2) discuss pheremones and visual signals;

(3) explain ways in which dominance hierarchy is beneficial to a society;

(4) list some advantages of territoriality;

(5) discuss aggressive behavior in animals; and

(6) discuss examples of courtship behavior in animals.

12.0 Social Biology

12.1 To demonstrate knowledge of the problem of human population growth, students will:

(1) discuss the past and present growth of the world population; and

(2) explain ways in which birth rate can be lowered.

12.2 To demonstrate knowledge of man's intervening role in nature students will:

(1) explain the importance of conservation of natural resources; and

(2) discuss the major causes of pollution of the following: water, air, soil, thermal, noise, nuclear, acid rain, and pesticide.

12.3 To demonstrate knowledge of the economic aspects of bacteria, algae, and fungi, students will:

(1) discuss ways in which the activities of bacteria, algae, and fungi are essential to life on earth; and

(2) discuss ways in which the knowledge of bacteria, algae, and fungi have been useful to man in medicine, food processing, and preservation.

+12.4 Students will investigate such bacteriological laboratory techniques as culturing, gram staining, or resistance to antibiotics.

12.5 To demonstrate knowledge of the implications of biomedical progress, students will:

(1) discuss artificial insemination, in-vitro fertilization, and cloning as examples of reproductive engineering; and

(2) discuss the positive and negative aspects of genetic engineering and counseling.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

County Adopted Materials: J. Kimble, Biology, 4th edition, (Reading, Mass.: Addison-Wesley Publishing Co., 1978).

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	Chemical Basis of Life	2 weeks	MLST/AP	Kimble, pp. 20-62, 100-07.	
2.0	Cells	2 weeks	MLST/AP	Kimble, pp. 64-100, 253-64.	
3.0	Energy Transformation	3 weeks	MLST/AP	Kimble, pp. 124-60.	
4.0	Genetics	4 weeks	MLST/AP	Kimble, pp. 266-341.	
5.0	Plant Structure and Function	2 weeks	MLST/AP	Kimble, pp. 84-86, 166-69, 211-27.	
6.0	Plant Reproduction and Development	2 weeks	MLST/AP	Kimble, pp. 344-56, 400-33.	
7.0	Animal Structure and Function	5 weeks	MLST/AP	Kimble, pp. 169-80, 186-209, 231-43, 440-54, 478-98.	

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KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
8.0	Animal Reproduction and Development	2 weeks	MLST/AP	Kimble, pp. 358-97.	
9.0	Origin of Life/ Evolution	3 weeks	MLST/AP	Kimble, pp. 11-15, 576-621, 662-719.	
10.0	Ecology	3 weeks	MLST/AP	Kimble, pp. 724-96.	
11.0	Behavior	1 week	AP	Kimble, pp. 527-49, 454-55.	
12.0	Social Biology	1 week	AP	Kimble, pp. 798-824, 326-29, 373-77.	

J. Kimble, Biology, 4th ed ion
(Reading, Mass.: Addison-Wesley
Co., 1978).

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
1.6.8	investigate the effect of temperature on enzyme activity.		J. Kimble, Biology, A Laboratory Introduction (Reading, Mass.: Addison-Wesley Co., 1967). pp. 27-31.
2.2.12	investigate the differences between plant and animal cells using light microscopy.		Kimble, pp. 27-31.
3.1.12	investigate the production of CO_2 by living organisms.		Biology II, Advanced Resource Packet
4.15	investigate the inheritance of a selected trait using Drosophila.		Kimble, pp. 111-17.
5.1.6	investigate the structure of a root, stem, leaf, flower, fruit, or seed.		Kimble, pp. 53-56.
6.4.6	investigate the effect of environmental or chemical influences on plant growth.		Kimble, pp. 63-72.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
7.1.7	investigate the effects of exercise on pulse rate, breathing rate, or blood pressure.		Biology II, Advanced Resource Packet
7.1.8	investigate the characteristics of human blood using such techniques as typing and Wright's stain.		Kimble, pp. 129-31.
7.1.16	perform a vertebrate dissection to identify the major organs of the digestive, respiratory, excretory, nervous, and circulatory systems.		Kimble, pp. 33-37, 49-52.
9.7.2	develop a taxonomic key to classify selected organisms.		Kimble, pp. 7, 8.
12.4	investigate the bacteriological lab techniques such as culturing, gram staining, or resistance to antibodies.		Kimble, pp. 119-28.

INTRODUCTION
ECOLOGY

State Accreditator Number	1365
Course Code Number	2625
F.T.E. Category	1.10
Instructional Level	Standard

Report Card Abbreviation	Ecology
Length of Course	Year
Credit	1 Science credit
Grade Level	10, 11, 12

Prerequisites

Biology I
Physical Science II or Chemistry I recommended

Textbook(s)

Greisel, I. and Jensch, P. Investigating Our Ecosystem (Atlanta: Houghton Mifflin, 1976).

Notes to Teachers

This course includes higher level as well as minimum level objectives. Students are to develop laboratory and field skills as well as content knowledge.

The Minimum Level Skills (MLS) objectives are indicated with an an asterisk (*) and will be the only objectives tested on the Minimum Level Skills Test (MLST). The "Teaching Time" listed on the Key to Instructional Materials is a suggested range, assuming no one will need the maximum time on every objective, to help ensure that all MLS objectives can be met by Minimum Level Skills Test time.

Laboratory and field skills are indicated with a plus sign (+). Suggested resources for teaching these skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources. A packet of resource materials for both field work and classroom activities is available from the science office, 390-2129.

ECOLOGY

- 1.0 The Ecosystem Concept
  - 1.1 Ecology Defined
  - 1.2 The Ecosystem
    - 1.2.1 Definition
    - *1.2.2 Basic components
    - *1.2.3 Examples: biotic, abiotic factors
  - 1.3 Units Within The Ecosystem
    - *1.3.1 Population structure
    - 1.3.2 Population examples
    - *1.3.3 Community structure
    - 1.3.4 Community examples
  - 1.4 Units Beyond The Ecosystem
    - 1.4.1 Biome examples
    - 1.4.2 Biosphere
  - +1.5 Field Study
    - 1.5.1 Area selection
    - 1.5.2 Map
    - 1.5.3 Physical aspects
    - 1.5.4 Plant life
    - 1.5.5 Animal life
    - 1.5.6 Sub-plot

- 2.0 Energy Flow
  - 2.1 Photosynthesis
    - 2.1.1 Sun
    - 2.1.2 Organisms
    - 2.1.3 Energy conversion
    - 2.1.4 Carbon conversion
    - *2.1.5 Location
    - +2.1.6 Conditions
  - 2.2 Production
    - 2.2.1 Primary: net, gross
    - 2.2.2 Measurement
    - 2.2.3 Limits
    - 2.2.4 Consumer
  - 2.3 Energy-releasing Processes
    - 2.3.1 Respiration
    - *2.3.2 Organisms
    - 2.3.3 Fermentation: definition
    - +2.3.4 Fermentation end products
    - 2.3.5 Aerobes/ Anaerobes
  - 2.4 Trophic Levels
    - *2.4.1 Autotrophs/ Heterotrophs
    - *2.4.2 Food consumed
    - *2.4.3 Food chain characteristics
    - *2.4.4 Level identification
    - 2.4.5 Decomposers
  - 2.5 Energy Pyramids
    - 2.5.1 Trophic levels
    - 2.5.2 Food chains
    - 2.5.3 Energy flow
    - *2.5.4 Energy loss
    - 2.5.5 Relative energy
  - 2.6 Biomass
    - *2.6.1 Definition
    - 2.6.2 Trophic levels
    - *2.6.3 Available energy
    - 2.6.4 Relative amounts
  - *2.7 Energy/Matter
  - 2.8 Energy Alternatives

- 3.0 The Biotic Community
  - 3.1 Symbiosis
    - *3.1.1 Examples
    - 3.1.2 Effects
  - 3.2 Habitat/Niche
    - 3.2.1 Definitions
    - 3.2.2 Descriptions
    - *3.2.3 Examples

* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

ECOLOGY

- 3.3 Competition
  - *3.3.1 Between species
  - 3.3.2 Within species
  - 3.3.3 Reducing competition
  - *3.3.4 Competition: degree
- *3.4 Food Web Characteristics
- 3.5 Pesticides
  - 3.5.1 Effects
  - 3.5.2 Alternatives
  - 3.5.3 Advantages/ Disadvantages

4.0 The Abiotic Environment

- 4.1 Water
  - 4.1.1 Properties
  - 4.1.2 Necessary elements
  - *4.1.3 Pollution sources
  - 4.1.4 Pollutants: types, sources
  - 4.1.5 Thermal pollution
- +4.2 Water Analysis
  - 4.2.1 Solids
  - 4.2.2 pH
  - 4.2.3 Ions
  - 4.2.4 Hardness
  - 4.2.5 Dissolved gases
  - 4.2.6 Organic matter
  - 4.2.7 Temperature/ Dissolved oxygen
- 4.3 The Water Cycle
  - 4.3.1 Diagram
  - *4.3.2 Atmosphere: transfer
  - 4.3.3 Living systems: entry
  - +4.3.4 Transpiration
- 4.4 Soil
  - *4.4.1 Components
  - 4.4.2 Formation
  - 4.4.3 Particles
  - *4.4.4 Necessary elements
- +4.5 Soil Analysis
  - 4.5.1 Texture
  - 4.5.2 Moisture
  - 4.5.3 Humus
  - 4.5.4 pH
  - 4.5.5 Ions
  - 4.5.6 Animal correlations
  - 4.5.7 Evaluation
- 4.6 Sedimentary Cycles
  - 4.6.1 Calcium
  - 4.6.2 Phosphorus
- 4.7 Air
  - *4.7.1 Elements
  - 4.7.2 Pollutants: types, sources
  - *4.7.3 Automobiles
  - 4.7.4 Wind
  - *4.7.5 Relative humidity
  - 4.7.6 Temperature inversions
- +4.8 Air Analysis
  - 4.8.1 Wind
  - 4.8.2 Relative humidity
  - 4.8.3 Relative humidity/ Temperature
  - 4.8.4 Particulate matter
- 4.9 Gaseous Cycles
  - 4.9.1 Carbon-oxygen diagram
  - *4.9.2 Organic/Inorganic carbon
  - 4.9.3 Nitrogen diagram
  - *4.9.4 Nitrogen-fixing bacteria
  - 4.9.5 Legumes
  - 4.9.6 Sulfur cycle
- 4.10 Noise
  - 4.10.1 Negative effects
  - 4.10.2 Harmful level
  - +4.10.3 Measurements
- 4.11 The Earth's Crust
  - 4.11.1 Earthquakes
  - 4.11.2 Volcanoes
  - *4.11.3 Resources

ECOLOGY

- 4.12 Resources
  - *4.12.1 Renewable/Non-renewable
  - 4.12.2 Current demands/Alternatives
- 4.13 Recycling
  - *4.13.1 Biodegradable substances
  - 4.13.2 Recycling opportunities
  - 4.13.3 Economic advantages
- 4.14 Pollution Problems
  - 4.14.1 Wastes/Sewage
  - 4.14.2 Chemical dumps
  - 4.14.3 Landfills
  - 4.14.4 Nuclear wastes
  - 4.14.5 Clean-up

5.0 Population Ecology

- 5.1 Populations: Open/Closed
- 5.2 Population Growth
  - *5.2.1 Determiners
  - 5.2.2 Environmental influences
  - *5.2.3 Growth curve: sigmoid, J-shaped
  - +5.2.4 Sample growth
  - *5.2.5 Carrying capacity
  - 5.2.6 Rate of change
- 5.3 Population Density
  - *5.3.1 Definition
  - 5.3.2 Calculations
  - 5.3.3 Sampling methods
  - +5.3.4 Taking a sample
  - 5.3.5 Sampling deviations
  - 5.3.6 Distribution: types
  - +5.3.7 Distribution determination
  - 5.3.8 Crowding
  - *5.3.9 Environmental factors: dependent, independent
- 5.4 Behavioral Regulation
  - 5.4.1 Territoriality
  - 5.4.2 Social dominance
  - 5.4.3 Courtship display
  - 5.4.4 Conflict
  - *5.4.5 Population limitation
  - 5.4.6 Social organization
- 5.5 Survival Adaptations
  - *5.5.1 Desert
  - 5.5.2 Cave
  - 5.5.3 Defense behavior
  - 5.5.4 Physical defense
  - 5.5.5 Food-getting
  - 5.5.6 Camouflage
  - *5.5.7 Mimicry
- 5.6 Human Population
  - 5.6.1 Growth rate
  - 5.6.2 Communicable diseases
  - 5.6.3 Food resources
  - 5.6.4 Deficiency disease
- 5.7 Extinction
  - *5.7.1 Endangered/Threatened
  - 5.7.2 Effects: extinction
  - 5.7.3 Local species
  - 5.7.4 Current progress
- 5.8 Wildlife Conservation

6.0 The Effects of Time

- 6.1 Succession
  - *6.1.1 Definition
  - 6.1.2 Primary/Secondary
  - 6.1.3 Pioneer plants
  - 6.1.4 Climax communities
  - *6.1.5 Stability/Complexity
  - 6.1.6 Productivity
- 6.2 Stages of Succession
  - *6.2.1 Primary types
  - 6.2.2 Secondary types
  - *6.2.3 Interruption: succession

ECOLOGY

- *6.3 Dynamic Equilibrium
- 6.4 Photoperiodism
- 6.5 Diurnal Rhythms
- 6.6 Seasonal Rhythms
  - *6.6.1 Survival: behavioral
  - *6.6.2 Survival: physical
  - +6.6.3 Temperature
  - +6.6.4 Plant life

7.0 Terrestrial Ecosystems

- 7.1 Biome Determiners
  - 7.1.1 Temperature/ Precipitation
  - 7.1.2 Latitude/ Altitude
- 7.2 Biome Characteristics
- 7.3 Local Area Analysis

8.0 Freshwater Ecosystems

- 8.1 Lakes
  - 8.1.1 Characteristics
  - 8.1.2 Turnover
  - 8.1.3 Food webs
  - 8.1.4 Algal blooms
  - 8.1.5 Pollution
- 8.2 Ponds
  - 8.2.1 Characteristics
  - 8.2.2 Food webs
  - 8.2.3 Pollution
- 8.3 Rivers/Streams
  - 8.3.1 Characteristics
  - 8.3.2 Food webs
  - 8.3.3 Pollution
- 8.4 Bogs/Marshes
  - 8.4.1 Characteristics
  - 8.4.2 Pollution

9.0 Marine Ecosystems

- 9.1 Currents/Tides
- 9.2 Estuaries/Marshes
  - 9.2.1 Characteristics
  - 9.2.2 Significance
  - 9.2.3 Food webs
  - 9.2.4 Pollution
- 9.3 Coastal Ecosystems
- 9.4 Open Oceans
- 9.5 Marine Food Chains

PERFORMANCE OBJECTIVES
ECOLOGY

To demonstrate the ability to recall and apply knowledge of the ecosystem concept, energy flow, biotic community, abiotic environment, population ecology, effects of time, terrestrial ecosystem, freshwater ecosystems, and marine ecosystems, students will master the performance objectives described below. Successful completion of this couse is based on teacher judgment and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 The Ecosystem Concept

1.1 Students will identify a definition of ecology.

1.2 To demonstrate knowledge of the ecosystem, students will:

(1) define ecosystem;

*(2) identify the two basic components of an ecosystem as the biotic and abiotic factors; and

*(3) classify environmental factors as biotic or abiotic.

1.3 To demonstrate knowledge of units within the ecosystem, students will:

*(1) identify a population as organisms of one species in a given area;

(2) list examples of populations;

*(3) identify a community as all the living things in a given area; and

(4) describe examples of communities.

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* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

1.4 To demonstrate knowledge of units beyond the ecosystem, students will:

(1) list examples of major biomes; and

(2) identify the components of the biosphere.

+1.5 To demonstrate knowledge of field study techniques, students will:

(1) select a natural area for study;

(2) construct a scaled map of the area;

(3) describe the physical aspects of the area;

(4) describe the plant life of the area;

(5) describe the animal life of the area; and

(6) designate a sub-plot for intensive study.

2.0 Energy Flow

2.1 To demonstrate knowledge of photosynthesis, students will:

(1) identify the sun as the original source of energy for all life on earth;

(2) identify the types of organisms that carry on photosynthesis;

(3) identify light energy as being converted to chemical energy in photosynthesis;

(4) identify inorganic carbon as being converted to organic carbon in photosynthesis;

*(5) identify photosynthesis as occurring more abundantly in bodies of water rather than on land; and

+(6) using laboratory methods, determine the effects of varying light intensities, light quality, CO_2 concentration, or temperature on the rate of photosynthesis.

2.2 To demonstrate knowledge of production, students will:

(1) differentiate between net and gross primary production;

(2) identify methods by which primary production can be measured;

(3) identify factors which limit the sun's total energy from being used for primary production; and

(4) define consumer production.

2.3 To demonstrate knowledge of energy-releasing processes, students will:

(1) define respiration;

*(2) identify respiration as a process carried on by almost all living organisms;

(3) define fermentation;

+(4) using laboratory methods, determine that CO_2 and energy are released by fermentation; and

(5) differentiate between aerobes and anaerobes.

2.4 To demonstrate knowledge of trophic levels, students will:

*(1) identify autotrophs as organisms that can make their own food from inorganic matter and heterotrophs as organisms that must rely on other living things for their food;

*(2) identify the types of food consumed by herbivores, carnivores, or omnivores as plants, meat, and both plant and animal material, respectively;

*(3) distinguish a properly diagrammed food chain from a food chain which is improperly diagrammed;

*(4) identify the trophic levels of individuals in a given food chain; and

(5) identify the importance of decomposers in the cycling of matter.

2.5 To demonstrate knowledge of energy pyramids, students will:

(1) indicate the trophic levels on an energy pyramid;

(2) place the organisms of a given food chain in an energy pyramid;

(3) indicate, using arrows, the flow of energy into, through, and out of a system;

*(4) identify energy as being lost, primarily as heat from respiration, at each trophic level; and

(5) calculate the relative amounts of energy at each level of an energy pyramid when given the amount of energy at one level.

2.6 To demonstrate knowledge of biomass, students will:

*(1) identify biomass as the amount of living material at a given trophic level or in an ecosystem;

(2) state that biomass decreases as one proceeds through the trophic levels;

*(3) identify biomass as being directly related to the amount of available energy; and

(4) calculate the relative biomass at each trophic level when given the biomass at one level.

*2.7 Students will identify the fundamental ecological difference between matter and energy as being the cycling of matter in an ecosystem compared to the one-directional flow of energy through the system.

2.8 Students will debate energy reliance on fossil fuels, nuclear power, solar power, and at least one other energy alternative.

3.0 The Biotic Community

3.1 To demonstrate knowledge of symbiosis, students will:

*(1) classify descriptions as examples of mutualism, commensalism, scavenging, parasitism, or predation; and

(2) identify as harmful, beneficial, or neutral the effects of types of symbiosis on the participants.

3.2 To demonstrate knowledge of habitat and niche, students will:

(1) define habitat and niche;

(2) describe the habitat and the niche of at least three organisms; and

*(3) determine whether a given example describes an organism's habitat or its niche.

3.3 To demonstrate knowledge of competition, students will:

*(1) identify nutrients, water, space, and shelter as factors for which competition between species would exist;

(2) identify mates, social dominance, and territory as factors for which only competition within a species would exist;

(3) describe mechanisms by which organisms reduce competition or increase their ability to succeed in competition; and

*(4) identify the predicted outcome as being a high level of competition if two organisms which occupy very similar niches come in contact with each other.

*3.4 Students will distinguish a properly diagrammed food web from a food web which is improperly diagrammed.

3.5 To demonstrate knowledge of pesticides, students will:

(1) identify the effects of pesticides on the food web;

(2) list examples of at least two alternatives to the use of pesticides; and

(3) describe the advantages and shortcomings of at least two alternatives to the use of pesticides.

4.0 The Abiotic Environment

4.1 To demonstrate knowledge of water, students will:

(1) identify two properties of water which make it important to the ecosystem;

(2) identify elements necessary for life which are usually obtained through water;

*(3) identify the three major sources of water pollution as municipal, industrial, and agricultural;

(4) identify types and sources of water pollutants; and

(5) describe causes and consequences of thermal pollution.

+4.2 To demonstrate knowledge of water analysis techniques, students will use laboratory and field methods to:

(1) calculate the amount of dissolved or undissolved solids in a water sample;

(2) determine the pH of a water sample;

(3) analyze the abundance of chloride, nitrate, or phosphate ions in a water sample;

(4) calculate the hardness of a water sample;

(5) analyze the amount of dissolved oxygen or carbon dioxide in a water sample;

(6) determine the presence or absence of bacteria, decaying animal matter, or dissolved cellulose material in a water sample; and

(7) relate the amount of dissolved oxygen to water temperature.

4.3 To demonstrate knowledge of the water cycle, students will:

(1) diagram the water cycle;

*(2) identify evaporation, respiration, and transpiration as processes which take water from the earth or living things to the atmosphere;

(3) identify processes by which water is taken into living systems; and

+(4) determine the effects of varying environmental conditions on the rate of transpiration, using laboratory methods.

4.4 To demonstrate knowledge of soil, students will:

*(1) identify rock and mineral fragments, water, air, microorganisms, organic debris, or chemical nutrients as a major component of soil;

(2) identify processes by which soil is formed;

(3) describe the types and relative sizes of soil particles; and

*(4) identify as elements necessary for life, phosphorus; and calcium, obtained primarily through the soil.

+4.5 To demonstrate knowledge of soil analysis techniques, students will use laboratory and field methods to:

(1) analyze the texture of a soil sample;

(2) determine the moisture content or moisture-holding capacity of a soil sample;

(3) calculate the percentage of organic matter in a soil sample;

(4) determine the pH of a soil sample;

(5) analyze the abundance of calcium, nitrate, or phosphate ions in a soil sample;

(6) correlate the soil organisms present in a soil sample with the levels of organic matter and moisture; and

(7) evaluate the overall ability of the soil to support plant and animal life.

(3) diagram the nitrogen cycle;

*(4) identify nitrogen-fixing bacteria as the only living things that can convert nitrogen gas to nitrates;

(5) describe the importance of legumes in restoring nitrates to the soil; and

(6) discuss the basic components of the sulfur cycle.

4.10 To demonstrate knowledge of noise, students will:

(1) list at least two harmful effects of excessive noise;

(2) identify the level at which noise becomes harmful; and

+(3) use a noise level meter to measure noise levels in at least three situations.

4.11 To demonstrate knowledge of the earth's crust, students will:

(1) list at least three ways in which earthquakes affect the ecosystem;

(2) identify at least one beneficial effect of volcanic activity; and

*(3) identify petroleum, iron, coal, ground water, phosphorus, or salt as resources available through mining the earth's crust.

4.12 To demonstrate knowledge of various resources, students will:

*(1) classify descriptions or examples of natural resources as renewable or non-renewable; and

(2) describe the current demands and alternatives of at least one non-renewable resource.

4.13 To demonstrate knowledge of recycling, students will:

*(1) identify definitions or examples of biodegradable substances;

(2) list at least three substances for which recycling opportunities exist in the community and describe one in detail; and

(3) discuss the economic advantages of recycling to both industry and the individual.

4.14 To demonstrate knowledge of pollution problems, students will:

(1) identify negative effects to the environment and public health resulting from the dumping of wastes and sewage;

(2) list problems which have arisen from the dumping of industrial chemicals;

(3) investigate the pros and cons of landfills;

(4) identify problems and precautions in the disposal of nuclear wastes; and

(5) list at least three measures which have been taken in this country to clean up pollution problems.

5.0 Population Ecology

5.1 Students will differentiate between open and closed populations.

5.2 To demonstrate knowledge of population growth, students will:

*(1) identify natality, mortality, immigration, or emigration as major growth determiners;

(2) list at least four environmental factors which influence population growth;

*(3) identify a sigmoid growth curve as typical of natural populations and a J-shaped growth curve as indicating rapid population growth;

+(4) measure growth of a population using laboratory methods;

*(5) identify carrying capacity as the maximum population size that can be supported by the environment; and

(6) calculate the rate of change of a given population.

5.3 To demonstrate knowledge of population density, students will:

*(1) identify population density as the number of individuals in relation to the space they occupy.

(2) calculate the density of given populations;

(3) describe at least three methods used to sample population density;

+(4) conduct a random sampling of a natural population;

(5) calculate deviation when given actual population density and results of a density sampling;

(6) identify uniform, random, and clumped as the three basic types of population distribution;

+(7) determine the type of distribution of at least one organism in their field study area;

(8) list at least three negative effects of overcrowding on a population; and

*(9) classify food, predation, shelter or infectious diseases as density-dependent environmental factors or temperature, volcanoes, earthquakes or floods as examples of density-independent environmental factors.

5.4 To demonstrate knowledge of behavioral regulation of populations, students will:

(1) describe one example of territoriality;

(2) discuss the establishment of social dominance in a population;

(3) describe the courtship display of at least one animal;

(4) identify threat, fighting, and submission as the three basic stages of a conflict;

*(5) identify territoriality, social dominance, courtship display, and conflict as behaviors limiting population growth by determining which individuals are permitted to produce offspring; and

(6) list at least two advantages gained through the establishment of a social organization in an animal population.

5.5 To demonstrate knowledge of survival adaptations, students will:

*(1) identify examples of survival adaptations found in desert plants or animals;

(2) identify examples of adaptations found in cave animals;

(3) list at least three behavioral adaptations for defense in the animal kingdom;

(4) describe at least five examples of physical adaptations for defense;

(5) describe at least three food-getting adaptations;

(6) list at least three animals with camouflage coloration; and

*(7) identify a given description as being an example of mimicry.

5.6 To demonstrate knowledge of human population, students will:

(1) graph data of human population growth;

(2) describe the relationships between population density and communicable diseases;

(3) discuss the relationship between human population and food resources; and

(4) write a short paper describing at least one deficiency disease which has obvious links to over-populated conditions.

5.7 To demonstrate knowledge of extinction, students will:

*(1) identify an endangered species as facing possible extinction throughout its range and a threatened species as facing possible extinction in some areas of its range.

(2) identify negative effects of extinction as reduction of the gene pool, simplification of the ecosystem, or aesthetic loss;

(3) list at least four animals and four plants which are on the endangered list in Florida; and

(4) describe measures which are being taken to improve survival chances of at least one endangered animal or plant.

5.8 To demonstrate knowledge of wildlife conservation, students will identify efforts, regulations, and responsibilities of the government and of individuals.

6.0 The Effects of Time

6.1 To demonstrate knowledge of succession, students will:

*(1) identify succession as a gradual change in the number and types of populations in an area;

(2) differentiate between primary and secondary succession;

(3) identify the pioneer plants in a given succession description;

(4) state that the climax community is the final stage of succession;

*(5) identify increasing community complexity as leading to increasing stability; and

(6) describe the changes in productivity and respiration as succession progresses.

6.2 To demonstrate knowledge of the stages of succession, students will:

*(1) identify, in order, the major stages of rock or dune succession:

(2) identify, in order, the stages of pond or cleared field succession; and

*(3) identify fire, volcanic eruptions, plowing, construction, flood, and grazing as factors which can interrupt succession.

*6.3 Students will identify a climax community as being in a state of dynamic equilibrium.

6.4 Students will state that photoperiodism is a major controller of growth and flowering in plants.

6.5 Students will describe at least two examples of diurnal rhythms.

6.6 To demonstrate knowledge of seasonal rhythms, students will:

*(1) identify migration, estivation, or hibernation as seasonal behaviors which increase survival chances of an organism;

*(2) identify color change, body fat levels, amount of fur, or changes in metabolic rate as seasonal body changes which increase survival chances of an organism;

+(3) using laboratory and field methods, correlate changes in air, soil, and water temperatures during at least five months of the year;

+(4) record seasonal changes in the plant life in the students' field study area.

7.0 Terrestrial Ecosystems

7.1 To demonstrate knowledge of biome determiners, students will:

(1) identify temperature and precipitation patterns as the two major determiners of biomes; and

(2) describe the effects of latitude and altitude on biome determination.

7.2 Students will describe at least five major types of biomes according to their physical factors, flora, and fauna.

7.3 Students will analyze the Jacksonville area, to classify the local biotic and abiotic elements.

8.0 Freshwater Ecosystems

8.1 To demonstrate knowledge of lakes, students will:

(1) list the major physical characteristics of lakes;

(2) discuss turnover, including its definition, its causes, and its importance to life in a lake;

(3) illustrate a typical lake food web;

(4) describe the causes and effects of algal blooms; and

(5) describe differences between a polluted lake and a non-polluted lake.

8.2 To demonstrate knowledge of ponds, students will:

(1) describe pond characteristics which are different from lake characteristics;

(2) diagram a local pond food web; and

(3) describe changes which occur in a pond as a result of pollution.

8.3 To demonstrate knowledge of rivers and streams, students will:

(1) describe the major physical characteristics of rivers and streams;

(2) diagram a typical flowing water food web; and

(3) identify major sources and effects of flowing water pollution.

8.4 To demonstrate knowledge of bogs and freshwater marshes, students will:

(1) describe the major natural characteristics of bogs and marshes; and

(2) describe characteristics indicative of a polluted bog or marsh.

9.0 Marine Ecosystems

9.1 Students will identify definitions of currents and tides.

9.2 To demonstrate knowledge of estuaries and salt water marshes, students will:

(1) describe the major characteristics of each;

(2) identify their significance as major breeding grounds;

(3) describe a Florida marsh or estuarine food web; and

(4) predict possible consequences of pollution of Florida's marshes and estuaries.

9.3 Students will describe the biotic and abiotic interactions in coastal ecosystems.

9.4 Students will describe the biotic and abiotic interactions in open ocean ecosystems.

9.5 Students will identify elements in marine food chains which have become especially significant to man.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	The Ecosystem Concept	2-3 weeks	MLST	I. Greisel and P. Jensch, Investigating Our Ecosystem (Atlanta: Houghton-Mifflin, 1976), pp. 2-35.	BSCS Revision Team, Biological Science: An Ecological Approach (New York: Rand McNally, 1978, 4th Ed.), pp. 33-40, 90-99. BSCS Revision Team, Biological Science: An Ecological Approach (New York: Rand McNally, 1973, 3rd Ed.), pp. 25-35, 63-81. J. Cunningham, Biology: You and Your Environment (Lexington, Mass.: D. C. Heath Co., 1976), pp. 179-80, 422, 456. D. R. Houston, Understanding The Game of the Environment: Agriculture Information Bulletin No. 426 (Washington, D. C.: U.S. Department of Agriculture, Forest Service, 1979), pp. 2-11. R. L. Smith, Ecology and Field Biology (New York: Harper and Row, 1966), pp. 3-25.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
2.0	Energy Flow	3-4 weeks	MLST	Greisel and Jensch, pp. 120-33, 141-49.	Biological Science: An Ecological Approach (1978), pp. 19-22, 92-93, 385-412, 692-94. Biological Science: An Ecological Approach (1973), pp. 12-18, 369-95. Cunningham, pp. 361-86, 407-11. Houston, pp. 38-51. Smith, pp. 27-48.
3.0	The Biotic Community	2-3 weeks	MLST	Greisel and Jensch, pp. 6-10.	Biological Science: An Ecological Approach (1978), pp. 15-21, 75-85, 94, 711-12. Biological Science: An Ecological Approach (1973), pp. 24-26, 65-74. Cunningham, pp. 52-60, 386, 449-72. Houston, pp. 11-31.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
3.0	The Biotic Community			(Continued)	Smith, pp. 29, 397-424.
4.0	The Abiotic Environment	6-8 weeks	MLST	Greisel and Jensch, pp. 36-119.	Biological Science: An Ecological Approach (1978), pp. 21-26, 85-89, 217-32, 694-700, 714-26. Biological Science: An Ecological Approach (1973), pp. 19-23, 74-78, 675-90. Cunningham, pp. 5-86, 181-85, 202-05, 442-48. Houston, pp. 33-37, 52-79, 105-55. Smith, pp. 48-97, 243-74 .
5.0	Population Ecology	4-6 weeks	MLST	Greisel and Jensch, pp. 140-44.	Biological Science: An Ecological Approach (1978), pp. 41-74, 204-08, 213-16, 484-532, 700-14. Biological Science: An Ecological Approach (1973), pp. 35-60, 479, 510, 667-82.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
					Cunningham, pp. 422-35, 448-54. Houston, pp. 101-04. Smith, pp. 341-96, 485-543. Endangered Species: An Educator's Handbook (Tallahassee, Florida: Environmental Education, Florida Department of Education and Florida Department of Natural Resources, 1978).
6.0	The Effects of Time	2-3 weeks	MLST	Greisel and Jensch, pp. 144-47.	Biological Science: An Ecological Approach (1978), pp. 260-63, 271-79. Biological Science: An Ecological Approach (1973), pp. 257-74. Cunningham, pp. 580-81. Houston, pp. 80-100. Smith, pp. 98-155.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
7.0	Terrestrial Ecosystems			Greisel and Jensch, pp. 137-40.	Biological Science: An Ecological Approach (1978), pp. 239-79. Biological Science: An Ecological Approach (1973), pp. 231-57. Cunningham, pp. 181-212. Smith, pp. 275-339.
8.0	Freshwater Ecosystems	2-4 weeks		Greisel and Jensch, pp. 38-43.	Biological Science: An Ecological Approach (1978), pp. 283-301. Biological Science: An Ecological Approach (1973), pp. 277-94. Smith, pp. 163-209.
9.0	Marine Ecosystems	1-4 weeks		Greisel and Jensch, p. 39.	Biological Science: An Ecological Approach (1978), pp. 301-16.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
9.0	Marine Ecosystems (Continued)				Biological Science: An Ecological Approach (1973), pp. 294-306. Smith, pp. 210-42.

I. Greisel and P. Jensch,
Investigating Our Ecosystem
(Atlanta: Houghton Mifflin
Company, 1976).

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+1.5.1	select a natural area for study.	21-23	Biological Science: An Ecological Approach (New York: Rand McNally and Company, 1973), p. 29. Ecology Resource Packet, (Duval County Public Schools, 1980). R. C. Oakes and K. House, An Introduction to Field Biology (New York: Holt Rinehart and Winston Incorporated, 1973), p. 1.
+1.5.2	construct a scaled map of the area.		Ecology Resource Packet. Oakes and House, pp. 3-7. E. A. Phillips, Field Ecology: A Laboratory Block (Boston: D. C. Heath and Company, 1964), pp. 28-31. R. L. Smith, Ecology and Field Biology (New York: Harper and Row, 1966), pp. 606-09.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+1.5.3	describe the physical aspects of the area.	23-35	Ecology Resource Packet. Phillips, pp. 3-27. (It is recommended that the laboratory activities in 4.0 be performed using the field study area to comply with this objective.)
+1.5.4	describe the plant life of the area.	24, 27-28, 34	Biological Science: An Ecological Approach, p. 30. Ecology Resource Packet. Oakes and House, pp. 7-10. Phillips, pp. 32-35. Smith, pp. 611-35.
+1.5.5	describe the animal life of the area.	24-25, 28, 30, 33-34	Biological Science: An Ecological Approach, pp. 32-32.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		J. Cunningham, *Biology: You and Your Environment* (Lexington, Mass.: D. C. Heath and Company, 1976), pp. 203, 218-22. *Ecology Resource Packet*. Oakes and House, pp. 24-27. Phillips, p. 36. Smith, pp. 636-68.
+1.5.6	designate a sub-plot for intensive study.		*Biological Science: An Ecological Approach*, pp. 29-30. *Ecology Resource Packet*. Oakes and House, pp. 5-6.
+2.1.6	by using laboratory methods, determine the effects of varying light intensities, light quality, CO_2 concentration, or temperature on the rate of photosynthesis.		*Biological Science: An Ecological Approach*, pp. 394-95. Cunningham, pp. 365-67.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+2.3.4	by using laboratory techniques, determine that CO_2 and energy are released by fermentation.		Biological Science: An Ecological Approach, pp. 379-80.
+4.2.1	calculate the amount of dissolved or undissolved solids in a water sample.	42-43	
+4.2.2	determine the pH of a water sample.	47-48	Smith, p. 600. (pH test paper is more simple to use than the series of indicators recommended in the adopted text.)
+4.2.3	analyze the abundance of chloride, nitrate, or phosphate ions in a water sample.	44-45, 55	Smith, p. 589.
+4.2.4	calculate the hardness of a water sample.		Smith, pp. 598-99.
+4.2.5	analyze the amount of dissolved oxygen or carbon dioxide in a water sample.	49, 54	Biological Science: An Ecological Approach, pp. 292-93. Smith, pp. 597-98.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+4.2.6	determine the presence or absence of bacteria, decaying animal matter, or dissolved cellulose material in a water sample.	33, 57, 59	
+4.2.7	relate the amount of dissolved oxygen to water temperature.	49	Teacher-prepared investigation, using resources specified in 4.2.5.
+4.3.4	determine the effects of varying environmental conditions on the rate of transpiration, using laboratory methods.		Biological Science: An Ecological Approach, pp. 404-05. Cunningham, p. 373. Phillips, pp. 62-65.
+4.5.1	analyze the texture of a soil sample.	65	Oakes and House, pp. 18-21. Phillips, p. 23. Smith, p. 605.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+4.5.2	determine the moisture content or moisture-holding capacity of a soil sample.	66	Oakes and House, pp. 22-23. Phillips, p. 24. Smith, p. 604.
+4.5.3	calculate the percentage of organic matter in a soil sample.	68	Cunningham, p. 205. Oakes and House, p. 23. Smith, p. 605.
+4.5.4	determine the pH of a soil sample.	69	Biological Science: An Ecological Approach, p. 221. Oakes and House, p. 18.
+4.5.5	analyze the abundance of calcium, nitrate, or phosphate ions in a soil sample.	69, 79	Phillips, p. 24.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+4.5.6	correlate the soil organisms present in a soil sample to the levels of organic matter and moisture.	73-74	
+4.5.7	evaluate the overall ability of the soil to support plant and animal life.		Teacher-prepared investigation.
+4.8.1	measure wind on at least three different occasions.		Ecology Resource Packet. Phillips, pp. 18-19.
+4.8.2	determine relative humidity on at least three different occasions.	89-90	Biological Science: An Ecological Approach, pp. 76-78. Oakes and House, pp. 18-20. Phillips, pp. 13-15. Smith, p. 603.
+4.8.3	correlate temperature and relative humidity by gathering at least five sets of data.		Teacher-prepared investigation, (incorporating procedures for 4.8.2)

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+4.8.4	in their study areas, measure the amount of particulate matter in the air.	93	Cunningham, p. 10.
+4.10.3	use a noise level meter to measure noise levels in at least three situations.		Ecology Resource Packet.
+5.2.4	measure growth of a population using laboratory methods.		Biological Science: An Ecological Approach, p. 36.
+5.3.4	conduct a random sampling of a natural population.		Biological Science: An Ecological Approach, pp. 63-65. Cunningham, p. 429. Phillips, pp. 37-61. Smith, pp. 611-20, 636-40, 649-57.
+5.3.7	determine the type of distribution of at least one organism in their field study area.		Teacher-prepared investigation.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+6.6.3	using laboratory and field methods, correlate changes in air, soil, and water temperatures during at least five months of the year.		Ecology Resource Packet.
+6.6.4	record seasonal changes in the plant life in their field study area.		Teacher-prepared investigation.

INTRODUCTION
SCIENCE RESEARCH, ADVANCED

State Accreditator Number	1329
Course Code Number	2511
F.T.E. Category	1.10
Instructional Level	Advanced

Report Card Abbreviation	Sci Research Adv
Length of Course	Year
Credit	1 Science credit
Grade Level	11, 12

Prerequisites

Departmental approval (see "Notes to Teachers, " below); current enrollment in Biology II, Advanced; Chemistry II, Advanced; Physics II, Advanced; or Marine Biology II, Advanced

Textbook(s)

None

Performance Objective

The senior high science student will complete an independent research project, presenting the results both orally and in writing to the satisfaction of the teacher.

Notes to Teachers

The Science Research course is designed to provide opportunity for interested students to participate in extensive, directed, individual research. Although there is much flexibility for both teacher and student, it is necessary that certain minimum standards be followed to ensure that advanced credit is warranted.

Prerequisites for acceptance into the course are:

1. Current enrollment in Biology II, Advanced; Chemistry II, Advanced; Marine Biology II, Advanced; or Physics II, Advanced.

INTRODUCTION
SCIENCE SURVEY - BIOLOGICAL

State Accreditator Number. .	1354
Course Code Number	2262
F.T.E. Category.	1.10
Instructional Level.	Standard

Report Card Abbreviation . .	Sci Survey-Bio
Length of Course	Year
Credit	1 Science credit
Grade Level.	10, 11, 12

Prerequisites

None

Textbook(s)

Oxenhorn, Joseph M., *Pathways In Biology* (New York: Globe Book Company, Inc., 1979).

Notes to Teachers

Performance objectives for Science Survey - Biological includes full objectives in addition to minimum level skills objectives. Students are to develop laboratory skills as well as content knowledge.

The Minimum Level Skills objectives are indicated with an asterisk (*), and will be the only objectives tested on the MLST. The "Teaching Time" listed on the "Key to Instructional Materials" is a suggested maximum time for each objective to help insure that all MLS objectives can be met by MLST time.

Laboratory skills are indicated with a plus sign (+). Suggested resources for teaching the laboratory skills have been listed in order of preferred use at the end of this section of the teacher's guide. Other resources may be substituted for or added to suggested laboratory resources.

COURSE OUTLINE

SCIENCE SURVEY - BIOLOGICAL

- 1.0 Cells
  - 1.1 Cell Structure
    - *1.1.1 Structure
    - *1.1.2 Functions
    - 1.1.3 Plant-animal cell differences
    - *1.1.4 Cancer definition
    - 1.1.5 Causes & effects of cancer
    - 1.1.6 Diffusion
  - 1.2 Microscope Parts
  - 1.3 Function of Microscope Parts
  - 1.4 Use & Care of Microscope
    - +1.4.1 Proper carrying & preparation of slide
    - 1.4.2 Image magnification computation
- 2.0 Human Systems
  - *2.1 Functions of Systems
  - *2.2 Structures of Systems
  - 2.3 Digestive System
    - 2.3.1 Function of organs
    - 2.3.2 Enzyme
    - 2.3.3 Importance of enzymes
    - +2.3.4 Enzyme activity
  - 2.4 Basic Nutrition
    - 2.4.1 Food groups
    - *2.4.2 Food group examples
    - 2.4.3 Vitamin
    - 2.4.4 Sources of vitamins
    - *2.4.5 Vitamin deficiency
    - 2.4.6 Balanced meal
    - 2.4.7 Chemical nutrients
    - 2.4.8 Importance of nutrients
    - +2.4.9 Chemical nutrients in foods
  - 2.5 Circulatory System
    - 2.5.1 Heart structure
    - 2.5.2 Blood flow in heart
    - 2.5.3 Blood structure
    - 2.5.4 Function of blood structures
    - +2.5.5 Blood cell differences
    - +2.5.6 Blood types
  - 2.6 Functions of Joints, Tendons, & Ligaments
  - 2.7 Muscular System: Voluntary & Involuntary
    - 2.7.1 Functions
    - 2.7.2 Examples
  - 2.8 Respiratory System
    - 2.8.1 Functions of organs
    - 2.8.2 Breathing & respiration differences
    - +2.8.3 Pollution
    - 2.8.4 Health effects of pollution & smoking
  - 2.9 Excretory System
    - 2.9.1 Auxillary excretory organs
    - 2.9.2 Composition similarit of urine & sweat
  - 2.10 Nervous System
    - 2.10.1 Function of organs
    - 2.10.2 Major brain parts
    - 2.10.3 Functions of brain parts
    - 2.10.4 Spinal cord
    - 2.10.5 Senses
- 3.0 Basic Genetics
  - *3.1 Basic Genetic Terms: Gene, Chromosome, Dominant Trait, Recessive Trait, Mutation.
  - *3.2 Importance of Chromosomes
  - 3.3 Chromosome Numbers
  - *3.4 Human Chromosome Number
  - 3.5 Sex Chromosomes
    - 3.5.1 X & Y Chromosomes
    - *3.5.2 Functions of X & Y
  - 3.6 Mutations of DNA
    - *3.6.1 Causes
    - 3.6.2 Effects
  - 3.7 Inherited Human Traits
    - 3.7.1 Examples
    - 3.7.2 Classification (dominant, recessive)

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* Indicates Minimum Level Skills.
+ Indicates laboratory skills.

SCIENCE SURVEY - BIOLOGICAL

- +3.7.3 Dominant-recessive
- 3.8 Genetic Diseases
  - 3.8.1 Definition
  - 3.8.2 Examples
- 3.9 Genetic Counseling (Importance)

4.0 Microorganisms

- 4.1 Bacteria: Characteristics & Effects
  - *4.1.1 Descriptions
  - +4.1.2 Growth
  - 4.1.3 Bacterial diseases
  - 4.1.4 Beneficial effects
- 4.2 Additional Pathogenic Microbes
  - *4.2.1 Caused by viruses
  - 4.2.2 Caused by fungi
- 4.3 Natural Disease Prevention
  - 4.3.1 Body defenses
  - 4.3.2 Functions of defenses
- 4.4 Acquired Disease Prevention
  - *4.4.1 Antibiotic
  - *4.4.2 Vaccination
  - 4.4.3 Vaccination & antibiotic (differences)

5.0 Plant & Animal Behavior

- *5.1 Behavior Terms: Stimulus, Response, & Behavior
- 5.2 Plant Behavior
  - *5.2.1 Examples of stimuli
  - 5.2.2 Examples of reponses
  - +5.2.3 Behavior observations
- 5.3 Animal Behavior
  - 5.3.1 Inborn & learned behaviors
  - *5.3.2 Inborn behavior (examples)
  - 5.3.3 Learned behavior (types)
  - 5.3.4 Learned behavior (examples)

6.0 Basic Botany

- 6.1 Plant Structure & Function
  - 6.1.1 Structure
  - *6.1.2 Functions
- 6.2 Process of Photosynthesis
  - *6.2.1 Function
  - *6.2.2 Substances required
  - 6.2.3 Products of photosynthesis
  - 6.2.4 Chlorophyll (Importance of)
- 6.3 Plant Reproduction
  - 6.3.1 Asexual & sexual reproduction
  - 6.3.2 Asexual & sexual reproduction (examples)
  - 6.3.3 Reproductive cells
  - 6.3.4 Fertilization
  - *6.3.5 Flower parts
  - *6.3.6 Function of flower parts
  - +6.3.7 Dissection (flower)
  - 6.3.8 Pollination
  - 6.3.9 Agents of pollination
  - 6.3.10 Pollination & fertilization

7.0 Ecology

- 7.1 Food Chain Structure
  - 7.1.1 Food chain
  - *7.1.2 Main source of energy
  - 7.1.3 Feeding levels
  - *7.1.4 Feeding level examples
  - +7.1.5 Feeding level observation
  - *7.1.6 Food chain examples
- 7.2 Food Web Structure
  - 7.2.1 Definition
  - 7.2.2 Examples
  - 7.2.3 Human effects
- 7.3 Population Interactions
  - *7.3.1 Population
  - *7.3.2 Population examples
  - 7.3.3 Ecological community
  - 7.3.4 Community relationships

SCIENCE SURVEY - BIOLOGICAL

- 7.4 Organisms & Environments (Major Life Zones)
  - 7.4.1 Abiotic characteristics
  - 7.4.2 Organisms

8.0 Organization of Data

- 8.1 Determining a Hypothesis
  - 8.1.1 Hypothesis
  - 8.1.2 Examples
- 8.2 Metric Measurement Instruments
  - 8.2.1 Identification
  - +8.2.2 Use
- 8.3 Use of Graphs
  - +8.3.1 Construction
  - 8.3.2 Interpretation

9.0 Animal Kingdom Survey

- 9.1 Classification Principles
- 9.2 Characteristics of Simple Animals: Protozoa, Sponges, Jellyfish, Worms
- 9.3 Characteristics of Arthropod Animals: Crayfish, Spider, Insects
- 9.4 Vertebrate Animals
  - 9.4.1 Major characteristics
  - +9.4.2 Examples

PERFORMANCE OBJECTIVES
SCIENCE SURVEY - BIOLOGICAL

To demonstrate the ability to recall and apply knowledge of cells, human systems, basic genetics, microorganisms, plant and animal behavior, basic botany, ecology, organization of data, and animal kingdom survey; students will master the performance objectives listed below. Successful completion of this course is based on teacher judgement and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 Cells

1.1 To demonstrate knowledge of cell structure, students will:

*(1) identify selected cell structures from a diagram: nucleus, cell membrane, cell wall, cytoplasm, or chloroplast, when given a diagram of cell structures;

*(2) identify the function of cell structures nucleus, cell membrane, cell wall, cytoplasm, or chloroplast;

(3) describe the structural differences between animal cells and plant cells, noting that cell wall and chloroplast are only in plant cells;

*(4) identify the definition of cancer as abnormal cell growth;

(5) identify the possible causes of cancer and the effects of cancer on the body; and

(6) define diffusion.

1.2 Students will identify the parts of a microscope (eyepiece, body tube, fine adjustment, coarse adjustment, objective lens, stage, arm, and base).

1.3 Students will describe the functions of specified microscope parts.

1.4 To demonstrate knowledge of the proper use and care of the microscope, students will:

+(1) correctly carry the microscope and prepare a wet-mount slide for viewing with the microscope and

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* Indicates Minimum Level Skills.
+ Indicates laboratory skills.

(2) compute the magnification of an image using the low-power objective of the microscope when given the magnification power of the eyepiece and the objective lens.

2.0 Human Systems

*2.1 Students will identify the function or functions of the skeletal, muscular, circulatory, digestive, respiratory, excretory, or nervous system.

*2.2 Students will identify which are the major parts of the skeletal, muscular, circulatory, digestive, respiratory, excretory, or nervous systems when given a list of body organs or structures.

2.3 To demonstrate knowledge of the digestive system, students will:

(1) identify the function or functions of the esophagus, stomach, small intestine, large intestine, liver, pancreas, or salivary glands;

(2) recognize the definition of enzyme;

(3) explain the importance of enzymes in digestion by stating that enzymes increase the availability of food energy because they speed up breakdown of food molecules; and

+(4) determine activity of enzymes in digestion by observing the action of saliva on starch.

2.4 To demonstrate knowledge of nutrition, students will:

(1) list the four basic food groups as milk, meat, fruit and vegetable, and bread and cereal;

*(2) select from several choices a typical representative of the basic food groups (milk, meat, fruit and vegetable, or bread and cereal) ;

(3) identify the definition of vitamin;

(4) match food sources with major vitamin or vitamins they supply ;

*(5) identify the effects on the body of vitamin deficiency;

(6) describe the composition of a balanced meal indicating correct proportions of foods from the basic food groups;

(7) list the major chemical nutrients as proteins, carbohydrates, and fats;

(8) describe the importance of the major chemical nutrients to the body; and

+(9) determine chemical nutrients of sample foods using standard nutrient test indicators.

2.5 To demonstrate knowledge of the circulatory system, students will:

(1) identify the major parts of the heart including the ventricle, atrium, valves, aorta, and vena cava;

(2) trace the flow of blood through the heart on a diagram of the internal view of a heart;

(3) identify the structural composition of blood by listing red cells, white cells, plasma, and platelets as blood structures; A, B, AB, and O as the major blood types; and Rh positive and Rh negative as different blood types;

(4) describe the function or functions of the blood structures (red cells, white cells, plasma, or platelets);

+(5) identify the difference between red and white blood cells by observing a stained sample of blood tissue; and

+(6) determine the blood type of a sample tissue using standard blood typing serum.

2.6 Students will identify the function of joints, ligaments, and tendons.

2.7 To demonstrate knowledge of the muscular system, students will:

(1) distinguish between the function of voluntary muscles and involuntary muscles by stating that involuntary muscles react without conscious control by the individual and

(2) identify the muscles that are voluntary and the muscles that are involuntary.

2.8 To demonstrate knowledge of the respiratory system, students will:

(1) identify the functions of the trachea, air sacs, lungs, or diaphragm;

(2) describe the difference between breathing and respiration by stating that breathing is the inhalation and exhalation of gases, and that respiration is the use of oxygen to release food energy;

+(3) determine the presence of air pollution by collecting samples of particulate matter from the air; and

(4) identify the effects on health of air pollution and smoking.

2.9 Students will (1) list the lungs, skin, and large intestine as auxilary organs of the excretory system and (2) describe the compositional similarity of urine and sweat specifically noting that both contain water, salt, and urea.

2.10 To demonstrate knowledge of the nervous system, students will:

(1) identify the functions of the brain, spinal cord, and nerves;

(2) identify major brain parts including cerebrum, cerebellum, medulla, and hypothalamus when given a diagram;

(3) identify the functions of the cerebrum, cerebellum, medulla, or hypothalamus;

(4) explain the importance of the spinal cord by stating that it is the only connection between the brain and nerves of the body; and

(5) explain the importance of the senses.

3.0 Basic Genetics

*3.1 Students will identify the definitions of gene, chromosome, dominant trait, recessive trait, or mutation.

*3.2 Students will identify the importance of chromosomes.

3.3 Students will state that the number of chromosomes determines the species of an organism.

*3.4 Students will identify the human chromosome number.

3.5 To demonstrate knowledge of the sex chromosomes, students will:

(1) list the sex chromosomes as X and Y, and

*(2) identify the function of the X and Y chromosomes as determining the sex of an individual.

3.6 To demonstrate knowledge of mutations of DNA, students will:

*(1) identify the causes of mutations as temperature, chemicals, or radiation and

(2) identify the effects of mutation on an organism as death, deformity, or variation.

3.7 To demonstrate knowledge of inherited human traits, students will:

(1) list several examples of common inherited traits including eye, skin or hair color, tongue-rolling, and height;

(2) classify human inherited traits as being dominant traits or recessive traits; and

+(3) determine examples of dominant and recessive traits by observing occurrence of selected traits in the class.

3.8 Students will identify (1) the definition of genetic disease and (2) the diseases which are genetic.

3.9 Students will relate the use of genetic counseling to the decrease in the probability of occurrence of genetic disease .

4.0 Microorganisms

4.1 To demonstrate knowledge of the characteristics and effects of bacteria, students will:

*(1) identify a description of bacteria;

+(2) identify which microbe growths are bacteria colonies when given a contaminated agar plate;

(3) identify diseases caused by bacteria; and

(4) identify an example of the beneficial activity of bacteria.

4.2 To demonstrate knowledge of additional pathogenic microbes, students will:

*(1) identify virus as the microbe which causes the common cold and flu; and

(2) list athlete's foot or ringworm as diseases caused by fungi.

4.3 Students will (1) list several body defenses including skin, white blood cells, and antibodies; and (2) match the mechanism of disease control with the body defense.

4.4 To demonstrate knowledge of acquired disease prevention, students will:

*(1) identify the definition of antibiotic;

*(2) identify how vaccinations control disease; and

(3) identify the difference in use of vaccinations and antibiotics for disease control.

5.0 Plant and Animal Behavior

*5.1 Students will identify the definitions of stimulus, response, and behavior.

5.2 To demonstrate knowledge of plant behavior, students will:

*(1) select from a description of a plant's behavior the stimulus for that behavior (light, water, gravity, or touch);

(2) draw the response of a plant when given a written or drawn description of a stimulus for plant behavior; and

+(3) observe plant behavior by subjecting experimental plants to different stimuli.

5.3 To demonstrate knowledge of animal behavior, students will:

(1) identify the definition of inborn and learned behavior;

*(2) identify migration, hibernation, or nest-building as inborn behaviors;

(3) list the types of learned behavior including habit, conditioned, trial and error, and problem solving; and

(4) identify examples of learned behavior as habit, conditioned, trial and error, and problem solving.

6.0 Basic Botany

6.1 To demonstrate knowledge of plant structure and function, students will:

(1) identify plant structures including leaf, stem, root, and flower when given a diagram; and

*(2) identify the functions of roots, stems, leaves, or flowers.

6.2 To demonstrate knowledge of the process of photosysthesis, students will:

*(1) identify the function of photosynthesis;

*(2) identify a substance required for photosynthesis as water or carbon dioxide;

(3) list oxygen and carbohydrates as the products of photosynthesis; and

(4) state that chlorophyll is necessary for the plant to do photosynthesis.

6.3 To demonstrate knowledge of plant reproduction, students will:

(1) identify the definition of sexual reproduction and asexual reproduction;

(2) classify examples of reproduction as asexual reproduction or sexual reproduction;

(3) identify the egg and sperm as the reproductive cells;

(4) identify the definition of the term fertilization as the union of egg and sperm cells;

*(5) identify the major parts of a flower as stamen, pistil, or ovary when given a diagram;

*(6) identify the functions of stamen, pistil, or ovary;

+(7) determine flower structure by dissecting a specified flower;

(8) identify the definition of pollination;

(9) list several examples of agents of pollination including bees and wind; and

(10) describe the difference between pollination and fertilization indicating that pollination occurs before fertilization.

7.0 Ecology

7.1 To demonstrate knowledge of the food chain structure, students will:

(1) identify the definition of food chain;

*(2) identify the sun as the main source of energy;

(3) identify the definitions of the feeding levels (producer, consumer, and decomposer);

*(4) identify examples of the feeding levels (producer, consumer, or decomposer);

+(5) classify organisms as being producer, consumer, or decomposer using laboratory methods; and

*(6) identify a correct food chain example.

7.2 To demonstrate knowledge of food web structure, students will:

(1) define food web

(2) draw a diagram showing a food web when given a list of organisms; and

(3) describe an effect of human activity on food webs such as the build up of pesticide contamination in organisms not intended to be affected by the pesticide.

7.3 To demonstrate knowledge of population interactions, students will:

*(1) identify the definition of population;

*(2) identify an example of a population;

(3) identify an ecological community as the interactions of several populations in an area; and

(4) describe community relationships including parasitism, predation, and competition.

7.4 To demonstrate knowledge of organisms and their environments, students will:

(1) describe the abiotic characteristics of major life zones by stating the typical climate or features of the desert, tundra, deciduous forest, or salt marsh; and

(2) match organisms with the life zone they are characteristic of including organisms of the desert, tundra, deciduous forest, and salt marsh.

8.0 Organization of Data

8.1 Students will (1) define hypothesis and (2) state a hypothesis for a specified observation.

8.2 To demonstrate knowledge of metric measurement instruments, students will:

(1) identify metric measurement instruments that are used to measure length, volume, temperature, or mass when shown appropriate laboratory devices and

+(2) measure the volume, length, temperature, or mass by using appropriate laboratory metric measurement instruments.

8.3 To demonstrate knowledge of the use of graphs, students will:

+(1) collect experimental data and prepare a bar graph showing the data (two variables) and

(2) interpret the information shown by a graph by stating at least one observation.

9.0 Animal Kingdom Survey

9.1 Students will state that organisms may be classified by structures, characteristics, or behaviors.

9.2 Students will match characteristic descriptions with simple animals : protozoa, sponges, jellyfish, and worms.

9.3 Students will match the characteristics of different arthropods with the arthropod animals, including crayfish, spider, and insect.

9.4 To demonstrate knowledge of vertebrate animals, students will:

(1) state the major characteristic of vertebrate groups including fish, amphibian, reptile, bird, and mammal; and

+(2) classify animals as fish, amphibian, reptile, bird, or mammal when given specimens of vertebrates.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	Cells	3 weeks	MLST	J. Oxenhorn, Pathways In Biology (New York: Globe Book Co., Inc., 1979), pp. 30-33, 59-63, 453-54.	E. Fabiano and E. Liberson, Life Activities and Explorations (Boston, Mass: Houghton Mifflin Co., 1975), pp. 107-28, 131-34.
2.0	Human Systems	9 weeks	MLST	Oxenhorn, pp. 76-77, 122-45, 154-90, 199-205, 223-32, 376, 464, 474-81, 563.	Fabiano and Liberson, pp. 134-60, 163-78, 181-96, 199-210, 213-24. J. Otto and A. Towle, Modern Biology (New York: Holt, Rinehart, and Winston, 1973), pp. 630-39.
3.0	Genetics	5 weeks	MLST	Oxenhorn, pp. 266-69, 338-87.	Fabiano and Liberson, pp. 275-88.
4.0	Microorganisms	3 week	MLST	Oxenhorn, pp. 66, 482-509.	Fabiano and Liberson, pp. 305-30.
5.0	Plant and Animal Behavior	3 weeks	MLST	Oxenhorn, pp. 210-11, 247-59.	Fabiano and Liberson, pp. 3-54, 70-74.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
6.0	Botany	3 weeks	MLST	Oxenhorn, pp. 97-105, 146-53, 283-89, 321-37.	Fabiano and Liberson, pp. 57-64, 239-53.
7.0	Ecology	3 weeks	MLST	Oxenhorn, pp. 513-34, 540-49, 565-67.	Fabiano and Liberson, pp. 77-104.
8.0	Organization of Data	3 weeks total (presented at various times during the course)		Oxenhorn, pp. 6-10, 25-29, 37-43.	Fabiano and Liberson, pp. 65-71, 148-49, 209-10, 279-82.
9.0	Animal Kingdom Survey	4 weeks		Oxenhorn, pp. 426-45.	Otto and Towle, pp. 439-617.

County Adopted Text:

J. Oxenhorn, Pathways In Biology (New York: Globe Book Company, Inc., 1979).

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+1.4.1	correctly carry the microscope and prepare a wet mount slide for viewing with the microscope.		J. Oxenhorn, Pathways In Biology Laboratory Manual (New York: Globe Book Company, Inc., 1975), pp. 19-22. E. Fabiano and E. Liberson, Life Activities and Explorations (Boston, Mass.: Houghton-Mifflin, 1975), pp. 109-17. A. Benson and E. Green, Laboratory Investigations In Biology (Morristown, N.J.: Silver Burdett, 1974), pp. 3-6. J. Otto, et al, Biology Investigations (New York: Holt, Rinehart and Winston, Inc., 1973), pp. 13-17.
+2.3.4	determine activity of enzymes in digestion by observing the action of saliva on starch.	9	Oxenhorn, pp. 119-20. Benson and Green, pp. 18-19. Fabiano and Liberson, pp. 158-59.
+2.4.9	determine chemical nutrients of sample foods using standard nutrient test indicators.	9, 122-23	Benson and Green, pp. 14-16. Fabiano and Liberson, pp. 141-45.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+2.5.5	identify the difference between red and white blood cells by observing a stained sample of blood tissue.		Oxenhorn, pp. 139-42. Benson and Green, pp. 65-66. Fabiano and Liberson, pp. 173-74.
+2.5.6	determine the blood type of a sample tissue using standard blood typing serum.		Oxenhorn, pp. 143-44. Benson and Green, p. 91. Fabiano and Liberson, p. 91.
+2.8.3	determine the presence of air pollution by collecting samples of particulate matter from the air.	563-64	Fabiano and Liberson, pp. 193-96.
+3.7.3	determine examples of dominant and recessive traits by observing occurrence of selected traits in the class.		Fabiano and Liberson, pp. 277-79. Otto, pp. 77-80.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+4.1.2	identify which microbe growths are bacteria colonies when given a contaminated agar plate.		Fabiano and Liberson, pp. 307-10. Benson and Green, pp. 104-05.
+5.2.3	observe plant behavior by subjecting experimental plants to different stimuli.		Oxenhorn, pp. 165-70. Fabiano and Liberson, pp. 70-74.
+6.3.7	determine flower structure by dissecting a specified flower.	328-29	Oxenhorn, pp. 181-84. Benson and Green, p. 80. Otto, pp. 213-16. Fabiano and Liberson, pp. 250-53.
+7.1.5	classify organisms as being producer, consumer, or decomposer using laboratory methods.		G. Uno, et al, Biological Science: An Ecological Approach (Chicago, Ill.: Rand McNally and Company, 1978), pp. 35-40. Fabiano and Liberson, pp. 79-80.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+8.2.2	measure the volume, length, temperature, or mass by using appropriate laboratory metric measurement instruments.		Oxenhorn, pp. 1-4, 5-8. Fabiano and Liberson, pp. 67-70, 148-49, 209-10.
+8.3.1	collect experimental data and prepare a bar graph showing the data (two variables).		Fabiano and Liberson, pp. 70-71, 279-82. Benson and Green, pp. 1-2.
+9.4.2	classify animals as fish, amphibian, reptile, bird, or mammal when given specimens of vertebrates.		Benson and Breen, pp. 43-45.

INTRODUCTION
ZOOLOGY

State Accreditator Number. .	1366
Course Code Number	2630
F.T.E. Category.	1.10
Instructional Level.	Standard

Report Card Abbreviation . .	Zoology
Length of Course	Year
Credit	1 Science credit
Grade Level.	11, 12

Prerequisites

Biology I

Textbook(s)

Storer, Tracy I., et al, Elements of Zoology (New York: McGraw-Hill, 1977).

Notes to Teachers

This course includes higher level as well as minimum level objectives. Students are to develop laboratory skills as well as content knowledge.

The Minimum Level Skills objectives are indicated with an asterisk (*) and will be the only objectives tested on the MLST. The "Teaching Time" listed on the "Key to Instructional Materials" is a suggested maximum time for each objective to help insure that all MLS objectives can be met by MLST time.

Laboratory skills are indicated with a plus sign (+). Suggested resources for teaching the laboratory skills have been listed at the end of this section of the teacher's guide. Other resources may be substituted for or added to the suggested laboratory resources.

The major emphasis of this course has been placed on vertebrate study. This approach was selected because of 1) the availability of Marine Biology I and II in secondary schools which include an extensive study of invertebrate phyla; 2) the ease of availability and maintenance of most vertebrates for classroom study; 3) the appeal of studying "more advanced" animals; and 4) the desire to make zoology more than a brief survey of the Animal Kingdom.

Two laboratory investigations, (1.7.1 and 7.5), have not been specified in this guide. This has been done to allow instructors freedom in selecting an activity appropriate to their own classroom situation and the availability of materials. Investigation 1.7.1 can be accomplished in a variety of ways. Investigation 7.5 would be best achieved by using slides of mixed protozoa By using this type of slide, students can compare many different classes in the same field of vision, and thus reinforce differences between the classes.

This guide contains essential labs and other resource material. A resource packet for zoology may be obtained by contacting the Science Office, 390-2129.

ZOOLOGY

- 1.0 General Concepts
  - 1.1 Definition of Zoology
  - 1.2 Branches of Zoology
  - 1.3 Historical Contributions
    - 1.3.1 Aristotle
    - 1.3.2 Hippocrates
    - 1.3.3 Galen
  - 1.4 Modern Zoology
  - *1.5 Characteristics of Living Things
  - 1.6 Scientific Method
    - +1.6.1 Steps
    - *1.6.2 Verification
    - *1.6.3 Theory
    - *1.6.4 Law

- 2.0 Animal Cells
  - 2.1 Robert Hooke
  - 2.2 Cell Theory
  - *2.3 Cell Parts
    - 2.3.1 Structures
    - 2.3.2 Organelles
    - 2.3.3 Function
  - 2.4 Physical Processes
    - 2.4.1 Osmosis
    - *2.4.2 Diffusion
    - *2.4.3 Active transport
    - 2.4.4 Pinocytosis
    - 2.4.5 Phagocytosis
    - 2.4.6 Cytoplasmic streaming
  - 2.5 Chemical Processes/Components
    - 2.5.1 Protoplasm
    - 2.5.2 Organic compounds
    - *2.5.3 Enzymes
    - 2.5.4 DNA
    - 2.5.5 Cellular metabolism
  - 2.6 Locomotion
  - *2.7 Mitosis
  - +2.8 Wet-Mount Preparation

- 3.0 Reproduction/Development
  - *3.1 Asexual Reproduction
  - *3.2 Sexual Reproduction
  - *3.3 Meiosis
  - 3.4 Development/Differentiation
    - 3.4.1 Cleavage
    - 3.4.2 Gastrulation
    - 3.4.3 Induction
    - 3.4.4 Determination
    - 3.4.5 Dedifferentiation
    - +3.4.6 Metamorphosis

- 4.0 Genetics
  - +4.1 Probability
  - 4.2 Mendelism
    - 4.2.1 Segregation
    - 4.2.2 Independant assortment
    - *4.2.3 Monohybrid cross
    - *4.2.4 Dihybrid cross
  - 4.3 Chromosome Theory
  - 4.4 Sex Determination
    - *4.4.1 Sex chromosomes
    - 4.4.2 Mosaics
  - 4.5 Sex Linkage
    - *4.5.1 X-linked genes
    - 4.5.2 Y-linked genes
    - 4.5.3 Sex-influenced traits
  - 4.6 Multiple Alleles
  - 4.7 Multiple Genes
  - *4.8 Pleiotropy
  - 4.9 Penetrance/Expressivity
  - 4.10 Lethal Genes
  - 4.11 Mutations
    - *4.11.1 Causes
    - 4.11.2 Reversals
  - 4.12 Hardy-Weinberg Principle
    - *4.12.1 Conditions
    - 4.12.2 Gene frequency
    - 4.12.3 Genetic equilibrium

* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

ZOOLOGY

5.0 Taxonomy

- 5.1 Linnaeus
- *5.2 Binomial Nomenclature
- 5.3 Speciation
  - *5.3.1 Definition of species
  - 5.3.2 Allopatry
  - 5.3.3 Sympatry
- *5.4 Taxonomic Hierarchy
- *5.5 Homologous Structures
- 5.6 Rules of Taxonomy
  - 5.6.1 Naming new species
  - 5.6.2 Law of Priority
- +5.7 Dichotomous Keys

6.0 Organic Evolution

- 6.1 Origin of Living Things
  - 6.1.1 Spontaneous generation
  - 6.1.2 Special creation
  - 6.1.3 Cosmozoic Theory
  - 6.1.4 Naturalistic Theory
- *6.2 Redi/Generation
- *6.3 Lamarckian Theory
- *6.4 Darwinian Theory
- 6.5 Evidence for Evolution
- *6.6 Biogenetic Law
- 6.7 Neo-Darwinism
- 6.8 Types of Evolution
  - 6.8.1 Divergent
  - 6.8.2 Convergent
  - 6.8.3 Sequential
- 6.9 Trends in Evolution
  - 6.9.1 Dollo's Law
  - 6.9.2 Cope's Law
  - 6.9.3 Gause's Rule
  - 6.9.4 Bergman's Rule
  - 6.9.5 Allen's Rule
  - 6.9.6 Interpretation
- 6.10 Mimicry/Protective Coloration
- *6.11 Adaptive Radiation

7.0 Unicellular Animals

- 7.1 Sarcodinians
  - *7.1.1 Structures
  - 7.1.2 Feeding/Digestion
  - 7.1.3 Respiration/Excretion
  - 7.1.4 Reproduction
- 7.2 Ciliates
  - *7.2.1 Structures
  - 7.2.2 Feeding/Digestion
  - 7.2.3 Respiration/Excretion
  - 7.2.4 Reproduction
- 7.3 Flagellates
  - *7.3.1 Structures
  - 7.3.2 Feeding/Digestion
  - 7.3.3 Respiration/Excretion
  - 7.3.4 Reproduction
- 7.4 Sporozoans
  - *7.4.1 Structures
  - 7.4.2 Feeding/Digestion
  - 7.4.3 Respiration/Excretion
  - 7.4.4 Reproduction
- +7.5 Microscopic Identification

8.0 Chordates

- 8.1 Primitive Chordates
  - *8.1.1 Characteristics
  - 8.1.2 Amphioxus
- 8.2 Fish
  - *8.2.1 Types
  - *8.2.2 Characteristics
  - 8.2.3 Gas exchange
  - 8.2.4 Transport system
  - 8.2.5 Feeding/ Digestion
  - 8.2.6 Excretion
  - 8.2.7 Reproduction
- 8.3 Amphibians
  - *8.3.1 Types
  - *8.3.2 Characteristics
  - 8.3.3 Gas exchange
  - 8.3.4 Transport system
  - 8.3.5 Feeding/Digestion
  - 8.3.6 Excretion
  - 8.3.7 Reproduction

ZOOLOGY

- 8.4 Reptiles
  - *8.4.1 Types
  - *8.4.2 Characteristics
  - 8.4.3 Gas exchange
  - 8.4.4 Transport system
  - 8.4.5 Feeding/Digestion
  - 8.4.6 Excretion
  - 8.4.7 Reproduction
- 8.5 Birds
  - *8.5.1 Types
  - *8.5.2 Characteristics
  - 8.5.3 Gas exchange
  - 8.5.4 Transport system
  - 8.5.5 Feeding/ Digestion
  - 8.5.6 Excretion
  - 8.5.7 Reproduction
  - *8.5.8 Flight
- 8.6 Mammals
  - *8.6.1 Types
  - *8.6.2 Characteristics
  - 8.6.3 Gas exchange
  - 8.6.4 Transport system
  - 8.6.5 Feeding/digestion
  - 8.6.6 Excretion
  - 8.6.7 Reproduction
- +8.7 Live Vertebrate Study

9.0 Animal Behavior

- 9.1 Taxis
- 9.2 Innate Behavior
  - 9.2.1 Courtship/ Breeding
  - 9.2.2 Migration/ Orientation
  - 9.2.3 Rhythms
- 9.3 Learned Behavior
  - 9.3.1 Conditioning
  - 9.3.2 Reinforcement
  - 9.3.3 Reasoning/ Intelligence
  - 9.3.4 Imprinting
- 9.4 Communication

10.0 Zoogeography

- 10.1 Tolerance
- 10.2 Leibig's Law
- 10.3 Niche/Habitat
- 10.4 Biomes/Animal Adaptations
- 10.5 Zoogeographic Realms
- 10.6 Continental Drift

PERFORMANCE OBJECTIVES
ZOOLOGY

To demonstrate the ability to recall and apply knowledge of general concepts, animal cells, animal reproduction and development, genetics, taxonomy, organic evolution, unicellular animals, chordates, animal behavior, and zoogeography, students will master the performance objectives listed below. Successful completion of this course is based on teacher judgment and the requirement that students pass the Minimum Level Skills Test.

Performance Objectives

1.0 General Concepts

1.1 Students will identify the definition of zoology.

1.2 Students will list at least five branches of zoology.

1.3 To demonstrate knowledge of historical contributions to zoology, students will:

(1) identify Aristotle as the first zoologist;

(2) identify Hippocrates as the first physiologist; and

(3) identify Galen as the scientist who related animal anatomy and physiology to humans.

1.4 Students will identify the scientific method as being characteristic of the era of modern zoology.

*1.5 Students will identify the four features characteristic of all living things as growth, need of nutrients, reproduction, and reaction to stimuli.

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* Indicates Minimum Level Skills
+ Indicates Laboratory Skills

1.6 To demonstrate knowledge of the scientific method students will:

+(1) use, in order, the steps of the scientific method in an investigation;

*(2) identify verification as the characteristic trait of the scientific method;

*(3) identify a theory as a definite statement based on experimental evidence; and

*(4) identify a law as a definite statement based on universal truth.

2.0 Animal Cells

2.1 Students will identify Robert Hooke as the scientist who discovered cells.

2.2 Students will state the cell theory.

*2.3 To demonstrate knowledge of cell structures, students will:

(1) identify from a diagram at least two cell structures;

(2) identify at least two cell organelles; and

(3) identify the function of cell membrane, nucleus, ribosomes, or mitochondria.

2.4 To demonstrate knowledge of physical processes in cells, students will:

(1) identify osmosis as the movement of water molecules through a semi-permeable membrane;

*(2) identify diffusion as the movement of molecules from an area of higher concentration to an area of lower concentration;

*(3) identify active transport as the movement of molecules from an area of lower concentration to an area of higher concentration;

(4) identify pinocytosis as the taking in of liquid droplets by cells;

(5) identify phagocytosis as the taking in of solid particles by cells; and

(6) identify cytoplasmic streaming as the process by which materials are distributed in a cell.

2.5 To demonstrate knowledge of chemical processes and components in cells, students will:

(1) identify protoplasm as the living material in cells;

(2) identify fats, carbohydrates, and proteins as the major groups of organic compounds in cells;

*(3) identify the role of enzymes as biological catalysts in cells;

(4) identify the function of DNA in cells; and

(5) identify cellular metabolism as the synthesis and breakdown of materials in cells.

2.6 Students will identify types of animal cell locomotion as ciliate, flagellate, or amoeboid.

*2.7 Students will identify the result of mitosis.

+2.8 Students will prepare a wet-mount of living animal cells for microscopic use.

3.0 Reproduction/Development

*3.1 Students will identify budding, regeneration, sporulation, fragmentation, or binary fission as examples of asexual reproduction.

3.2 Students will identify an example of sexual reproduction to be either fertilization or conjugation.

*3.3 Students will identify the result of meiosis as formation of cells with one half the number of chromosomes of the parent cell.

3.4 To demonstrate knowledge of development and differentiation, students will:

(1) identify cleavage as the division of an egg cell into many cells;

(2) identify gastrulation as the process by which an embryo develops a multicellular wall;

(3) identify induction as the process which regulates the timing and sequencing of embryonic events;

(4) identify determination as the regulation of the tissue type that embryonic material will produce;

(5) identify dedifferentiation as the ability to deprogram specific embryonic tissue, and

+(6) observe and record the daily changes in physical appearance of amphibian larvae as they undergo development and metamorphosis.

4.0 Genetics

+4.1 Students will observe and record data from an investigation dealing with probability of coin tosses, dice, or playing cards, and use the data to predict expected probabilities.

4.2 To demonstrate knowledge of Mendelism, students will:

(1) identify segregation as the separation of members of a gene pair during gamete formation;

(2) identify independent assortment as the random distribution of a gene pair during gamete formation;

*(3) predict phenotypic or genotypic ratios from a monohybrid cross; and

*(4) predict genotypic or phenotypic ratios from a dihybrid cross.

4.3 Students will describe the chromosome theory of heredity.

4.4 To demonstrate knowledge of sex determination, students will:

*(1) identify the Y chromosome as the determiner of the sex of most animals; and

(2) identify mosaics as having tissues of both male and female.

4.5 To demonstrate knowledge of sex-linkage, students will:

*(1) identify as examples of sex-linked traits, white eyes in fruit flies, barred plummage in poultry, or calico coat in cats;

(2) identify as examples of traits linked to the Y chromosome, hairy earlobes or brown tooth enamel; and

(3) define sex-influenced traits.

4.6 Students will describe multiple alleles as many distinct forms of the same gene.

4.7 Students will describe multiple genes as two or more genes producing one phenotype.

*4.8 Students will identify pleiotropy as one gene producing multiple genetic expressions.

4.9 Students will identify penetrance and expressivity as factors which affect the degree and depth of the phenotypic expression of a trait.

4.10 Students will define lethal genes.

4.11 To demonstrate knowledge of mutations, students will:

*(1) identify radiation, chemicals, or temperature as causes of mutations; and

(2) state that mutations are reversible.

4.12 To demonstrate knowledge of the Hardy-Weinberg Principle, students will:

*(1) identify the conditions necessary for a gene frequency to remain constant as the absence of immigration or emigration, viability of all gene forms, random mating, and reversibility of mutations.

(2) identify gene frequency as the frequency of occurrence of an allele in population; and

(3) identify genetic equilibrium as being produced in a population where gene frequencies are constant.

5.0 Taxonomy

5.1 Students will identify Linnaeus as the naturalist who devised the modern system of taxonomy.

*5.2 Students will identify binomial nomenclature as the system in taxonomy used to name animals.

5.3 To demonstrate knowledge of speciation, students will:

*(1) identify a species as a group of organisms which are potentially capable of interbreeding and producing viable, fertile young;

(2) identify allopatry as the geographic division of a population; and

(3) identify sympatry as two or more distinct populations occupying the same geographic area.

*5.4 Students will identify, in order, the levels of the taxonomic hierarchy.

*5.5 Students will identify homologous structures as structures being of common origin and ancestry.

5.6 To demonstrate knowledge of the rules of taxonomy, students will:

(1) outline the steps taken to name a new species; and

(2) identify the Law of Priority.

+5.7 Students will prepare dichotomous keys from specimens or materials available in the classroom.

6.0 Organic Evolution

6.1 To demonstrate knowledge of the origin of living things, students will:

(1) define 'spontaneous generation' as life originating suddenly from non-living materials;

(2) define 'special creation' as life being created by a supernatural power and remaining unchanged through time;

(3) define the Cosmozoic Theory as the origination of life from extra-terrestrial sources; and

(4) define the Naturalistic Theory as the formation of life from chemical origins under ideal environmental conditions.

*6.2 Students will identify Redi as the scientist who disproved spontaneous generation.

*6.3 Students will identify Lamarckian Theory as evolution based upon acquired characteristics.

*6.4 Students will identify Darwinian Theory as evolution based upon natural selection.

6.5 Students will state that evidence for evolution is provided by comparative anatomy, comparative physiology, and comparative embryology.

*6.6 Students will identify the biogenetic law as "ontogeny recapitulates phylogeny."

6.7 Students wil explain Neo-Darwinism.

6.8 To demonstrate knowledge of the types of evolution, students will:

(1) identify divergent evolution as two lines from a common source;

(2) identify convergent evolution as two lines toward a common form; and

(3) identify sequential evolution as being from generation to generation.

6.9 To demonstrate knowledge of trends in evolution, students will:

(1) identify Dollo's Law as stating that evolution is an irreversible process;

(2) identify Cope's Law as stating that evolution tends to increase the size of animals;

(3) identify Gause's Rule as stating that two species cannot occupy the same niche indefinitely;

(4) identify Bergman's Rule as stating that birds and mammals are larger in colder parts of their range than in warmer areas;

(5) identify Allen's Rule as stating that in cold regions birds and mammals have shorter extremities than related forms in warmer areas; and

(6) interpret a paragraph on the behavior of a selected group of animals according to accepted evolutionary rules and laws.

6.10 Students will identify mimicry and protective coloration as adaptations against predation.

*6.11 Students will identify adaptive radiation as diversity of forms from a common source.

7.0 Unicellular Animals

7.1 To demonstrate knowledge of sarcodinians, students will:

*(1) identify the two structural characteristics of Amoeba as pseudopods and a lack of definite shape;

(2) describe the method of feeding and digestion in Amoeba;

(3) identify the method of respiration and excretion in Amoeba; and

(4) explain the method of reproduction in Amoeba.

7.2 To demonstrate knowledge of ciliates, students will:

*(1) identify two characteristic structures of Paramecium as cilia and oral groove,

(2) describe the method of feeding and digestion in Paramecium;

(3) explain the method of respiration and excretion in Paramecium; and

(4) identify the methods of reproduction of Paramecium as binary fission and conjugation.

7.3 To demonstrate knowledge of flagellates, students will:

*(1) identify two characteristic structures of Euglena as flagella and plastids;

(2) describe the methods of feeding and digestion in Euglena;

(3) identify the methods of respiration and excretion in Euglena; and

(4) describe the method of reproduction in Euglena.

7.4 To demonstrate knowledge of sporozoans, students will:

*(1) identify two characteristics of Plasmodium as the absence of locomotor organelles and no contractile vacuole;

(2) describe the method of feeding and digestion in Plasmodium;

(3) explain the method of respiration and excretion in Plasmodium; and

(4) identify the methods of reproduction in Plasmodium as multiple fission and sexual reproduction through gametes.

+7.5 Students will view prepared microscope slides of representative protozoa and identify the taxonomic class of each specimen by using characteristics of the class.

8.0 Chordates

8.1 To demonstrate knowledge of primitive chordates, students will:

*(1) identify the characteristics of primitive chordates as notocord, dorsal nerve cord, and gill pouches; and

(2) identify amphioxus as the ancestral link to more advanced chordates.

8.2 To demonstrate knowledge of fish, students will:

*(1) identify the types of fish as jawless, cartilaginous, and bony;

*(2) identify the characteristics of fish as gills, two-chambered heart, poikilothermy, and cranium;

(3) describe gas exchange;

(4) explain how nutrients are transported;

(5) explain the methods of feeding and digestion;

(6) identify the method of excretion; and

(7) identify the methods of reproduction.

8.3 To demonstrate knowledge of amphibians, students will:

*(1) identify the types of amphibians as frogs and toads, caecilians, and salamanders;

*(2) identify the characteristics of amiphibians as moist skin, three-chambered heart, poikilothermy, and surface mucuous glands;

(3) explain the method of gas exchange;

(4) describe the method of transport of nutrients;

(5) explain the method of feeding and digestion;

(6) identify the method of excretion; and

(7) describe the method of reproduction.

8.4 To demonstrate knowledge of reptiles, students will:

*(1) identify the types of reptiles as snakes, lizards, turtles, crocodilians, and tuataras;

*(2) identify the characteristics of reptiles as scales, three-chambered heart, poikilothermy, and lungs;

(3) explain the method of gas exchange;

(4) describe the method of transport of nutrients;

(5) identify the method of feeding and digestion;

(6) identify the method of excretion; and

(7) compare the methods of reproduction.

8.5 To demonstrate knowledge of birds, students will:

*(1) identify the types of birds as perching, wading, and swimming;

*(2) identify the characteristics of birds as feathers, four-chambered heart, homeothermy, and lungs;

(3) describe the method of gas exchange;

(4) explain the method of transport of nutrients;

(5) identify the method of feeding and digestion;

(6) identify the method of excretion;

(7) explain the method of reproduction; and

*(8) identify the three modifications for flight in birds as hollow bones containing air sacks, enlarged breast muscles with an abundant supply of blood vessels, and feathers.

8.6 To demonstrate knowledge of mammals, students will:

*(1) identify the types of mammals as placentals, marsupials, and monotremes;

*(2) identify the characteristics of mammals as hair, four-chambered heart, homeothermy, and mammary glands;

(3) explain the method of gas exchange;

(4) describe the method of transport of nutrients;

(5) identify the method of feeding and digestion;

(6) identify the method of excretion; and

(7) contrast the methods of reproduction.

+8.7 Students will collect and maintain in captivity a living, non-domesticated vertebrate.

9.0 Animal Behavior

9.1 Students will identify taxis as a behavioral response toward or away from a stimulus.

9.2 To demonstrate knowledge of innate behavior, students will:

(1) describe courtship and breeding habits of one species of birds and one species of mammals;

(2) describe two theories of bird migration and orientation; and

(3) identify four types of rhythms.

9.3 To demonstrate knowledge of learned behavior, students will:

(1) describe conditioning;

(2) compare the effects of negative versus positive reinforcement;

(3) differentiate between intelligence and reasoning; and

(4) describe Lorenz's experiments with imprinting of ducks and geese.

9.4 Students will list the five types of animal communication.

10.0 Zoogeography

10.1 Students will define tolerance.

10.2 Students will explain Liebig's Law.

10.3 Students will relate niche to habitat.

10.4 Students will describe two adaptations for life in the following biomes: Tundra, Taiga, Temperate Deciduous Forest, Temperate Grassland, Tropical Grassland, Tropical Rainforest, and Desert.

10.5 Students will summarize the reasons for creation of zoogeographic realms.

10.6 Students will describe the theory of continental drift.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
1.0	General Concepts	1-2 Weeks	MLST	Storer, Tracy I., et al, Elements of Zoology (New York: McGraw-Hill, 1977), pp. 4-12.	Cockrum, E. Lendell and William J. McCauley, Zoology (Philadelphia: W. B. Saunders, 1965), pp. 7-11.
2.0	Animal Cells	2-3 Weeks	MLST	Storer, pp. 14-19, 33-42.	Cockrum, pp. 16-24, 26-37, 40-63.
3.0	Reproduction/ Development	1-2 Weeks	MLST	Storer, pp. 108-09.	Cockrum, pp. 68-85, 21-22.
4.0	Genetics	4-6 Weeks	MLST	Storer, pp. 152-71.	Cockrum, pp. 87-99, 102-18, 634-37.
5.0	Taxonomy	2-3 Weeks	MLST	Storer, pp. 221-23, 229-31, 235.	Cockrum, pp. 123-29, 643-45.
6.0	Organic Evolution	3-4 Weeks	MLST	Storer, pp. 134, 203-20.	Cockrum, pp. 354-56, 614-48.
7.0	Unicellular Animals	1-2 Weeks	MLST	Storer, pp. 254-68.	Cockrum, pp. 138-58.

KEY TO RECOMMENDED INSTRUCTIONAL MATERIALS

Performance Objective		Instructional Implications		Resources	
Number	Topic	Teaching Time	Tested on	County Adopted	Supplementary
8.0	Chordates	10-12 Weeks	MLST	Storer, pp. 380-457.	Cockrum, pp. 465-589.
9.0	Animal Behavior	2-3 Weeks		Storer, pp. 109-10, 128-32, 143, 183, 440-41.	Cockrum, pp. 328-29, 334-38, 343, 56-566.
10.0	Zoogeography	2-3 Weeks		Storer, pp. 173-77, 180-81, 192-200.	Cockrum, pp. 539-40, 359-60, 363-72.

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+1.7.1	use, in order, the steps of the scientific method in an investigation.		See "Notes to Teachers," Senior High School Biological Science (Duval County Public Schools).
+2.8	prepare a wet mount of living animal cells.		Zoology Resource Packet
+3.4.6	observe and record the daily changes in physical appearance of amphibian larvae as they undergo development and metamorphosis.		Zoology Resource Packet
+4.1	observe and record data from an investigation dealing with the probability of coin tosses, dice, or playing cards, and use the data to predict expected events.		Zoology Resource Packet
+5.7	prepare a dichotomous key from specimens or materials available in the laboratory.		Zoology Resource Packet

KEY TO LABORATORY RESOURCES

Objective	Skill	County Adopted Text Pages	Other Resources
	Students will:		
+7.5	view prepared microscope slides of representative protozoa, and identify the taxonomic class of each specimen by using characteristics of the class.		See "Notes to Teachers," Senior High School Biological Science (Duval County Public Schools, 1981).
+8.7	collect and maintain in captivity, a living non-domesticated vertebrate.		Zoology Resource Packet

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